

# Excavations at Arku Cave, Northeast Luzon, Philippines

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BARBARA THIEL

## INTRODUCTION

ARKU CAVE IS A LARGE limestone cave located in the municipality of Penablanca, Cagayan Province, in northern Luzon, Philippines (Figure 1). The cave is in the western foothills of the Sierra Madre Mountains. This area is part of the Callao limestone formation, which stretches in a long narrow belt along this part of the western edge of the mountains (Wasson and Cochran 1979). Arku Cave is in the central part of this formation.

There are many archaeological sites in this region. From November 1976 to February 1977 researchers from the National Museum of the Philippines conducted an archaeological survey of approximately 35 km<sup>2</sup> in the area surrounding Arku Cave. Seventy-one caves and seven rockshelters were located, 43 of which have archaeological remains. These are primarily habitation sites. Twenty-one open sites, lithic workshops, and habitation sites were also found (Ronquillo and Santiago 1977).

Arku Cave was used as a burial cave from approximately 2200 to 50 B.C. Bones of approximately 57 people were excavated from a variety of types of secondary burials. Grave goods included pottery and various ornaments and tools such as earrings, beads, bracelets, adzes, spindle whorls, and bone points.

## ENVIRONMENT

The western foothills of the Sierra Madre Mountains, where Arku Cave is located, is in a transition zone between two major physiographic regions, the Cagayan Valley and the Sierra Madre Mountains. To the west is the Cagayan Valley region, which consists of the valleys of the Cagayan River, three major tributaries, and numerous smaller tributaries. The discharge volume of the Cagayan River is the largest in the Philippines. The Cagayan Valley region is 250 km long and from 70 to 100 km wide. The valley is bounded on the east by the Sierra Madre Mountains, a range of rugged mountains with peaks over 1800 m. To the south are the Caraballo Mountains, and the western boundary is the Cordillera Central, a high mountain complex with several peaks over 3000 m

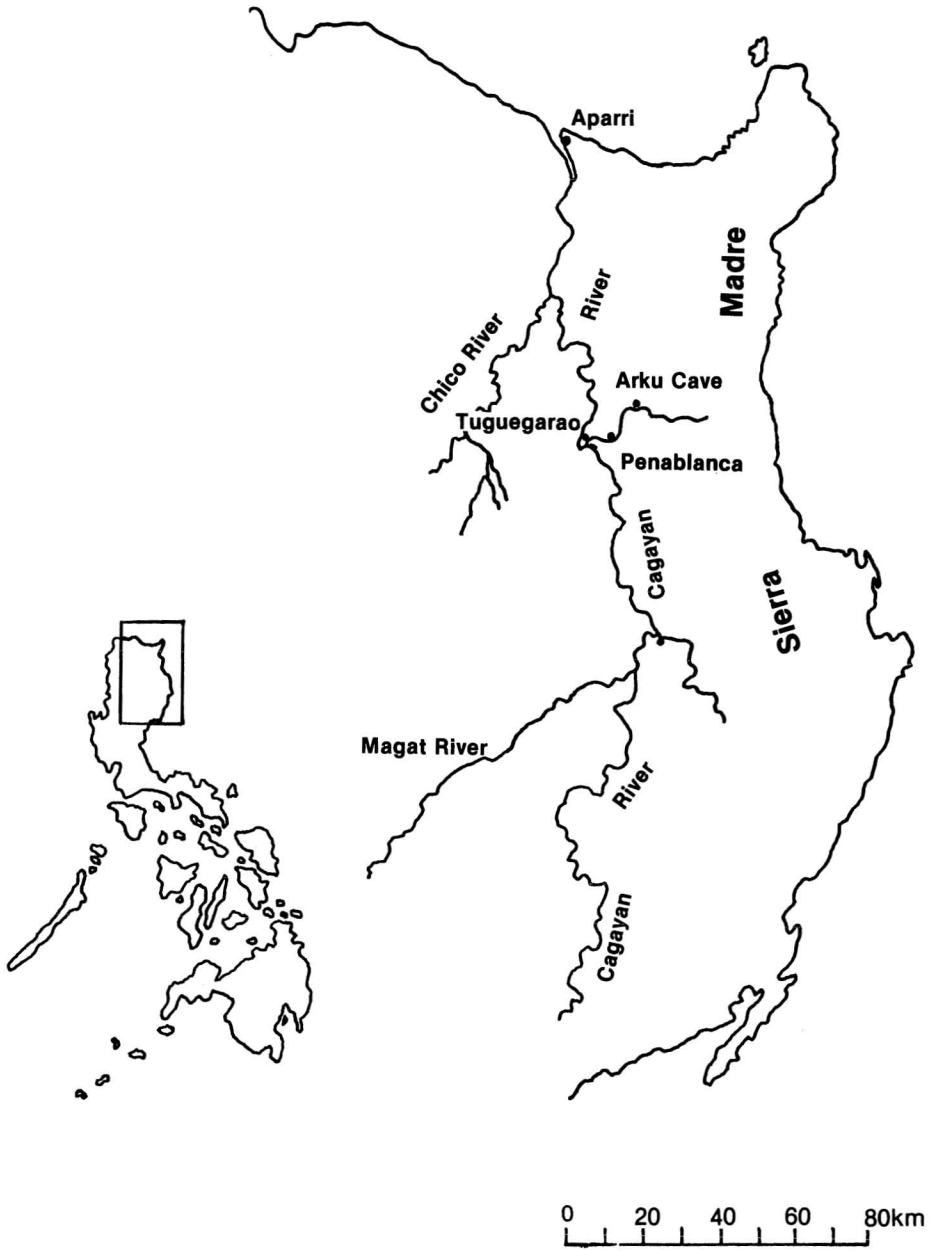


Fig. 1. Northeast Luzon.

(Wernstedt and Spencer 1967:314). Many regions of the valley itself are quite hilly, but elevations are seldom over 500 m.

The climate of the Cagayan Valley is somewhat different from other areas in the Philippines because it is closed off to the east, south, and west by mountains and has a higher latitude. Annual rainfall ranges from 150 to 200 cm per year. Most is received from June to November; the remaining months are usually dry. Typhoons are frequent in northern Luzon, but the effect is minimized in the Cagayan Valley because of the protection of the surrounding mountains. There is a greater seasonal temperature range than in the rest of the Philippines because of the interior location of the valley and the higher latitude. The natural vegetation of the region is dipterocarp forest (Wernstedt and Spencer 1967:91, 316).

The second physiographic region is the Sierra Madre Mountains, which spread from the eastern edge of the Cagayan Valley to the east coast of Luzon, a distance of 35 to 65 km. This area is much wetter, receiving well over 250 cm of rain per year. The heaviest rains usually occur from October through March, though the other months also receive rain. The area is also subject to frequent typhoons. The natural vegetation of this area is monsoon dipterocarp forest (Wernstedt and Spencer 1967:92, 424). The region contains numerous rivers that flow west into the Cagayan River or east into the Pacific Ocean.

The area of Arku Cave generally has the rainfall pattern of the mountains and not the valley; most rain falls from October to March, which is also when typhoons are most likely. This season generally has unbroken cloud cover for months at a time. In the winter, from November to February, the air pattern is controlled by the Northeast Monsoon, which has its source in Siberia and northern China. Temperatures are often 10–13 °C (50–55 °F), with a strong cold wind. Summer temperatures average 35–38 °C (95–100 °F), with very high humidity (Wernstedt and Spencer 1967:45, 49). Near Arku Cave the Cagayan Valley is particularly narrow. It is only about 25 km from the Cagayan River to the high peaks of the Sierra Madre.

Arku Cave is 250 m above sea level and is situated in a cliff overlooking the Pinacanan de Tuguegarao River, a tributary of the Cagayan River. The river at this point is 45 m above sea level.

### ARKU CAVE

The cave is 60 m long; it varies in width from 12 to 20 m and in height from 3 to 9 m. The front opening faces south and is 17 m wide and 9 m high. The cave cannot be entered from the front opening because there is an almost vertical drop to the river below; it must be entered from a small back opening from the hill behind the cave. Directly inside this opening is an 8 m high pile of rubble that one must descend to reach the cave floor. The floor is generally level except for an area in the east half of the cave extending from the front opening back about 15 m. In this area many large (25 cm to 2 m) stones have fallen from the ceiling, making the area 1–2 m higher than the rest of the cave floor. The extreme southwestern area of the cave slopes 2–3 m to the cave mouth (Fig. 2, 3).

The surface of the cave, particularly in the front half, was littered with earthenware sherds. There were also many human bones, particularly in the southeast stony area. Unfortunately, pothunters had been to the cave and had left one large and several smaller potholes.

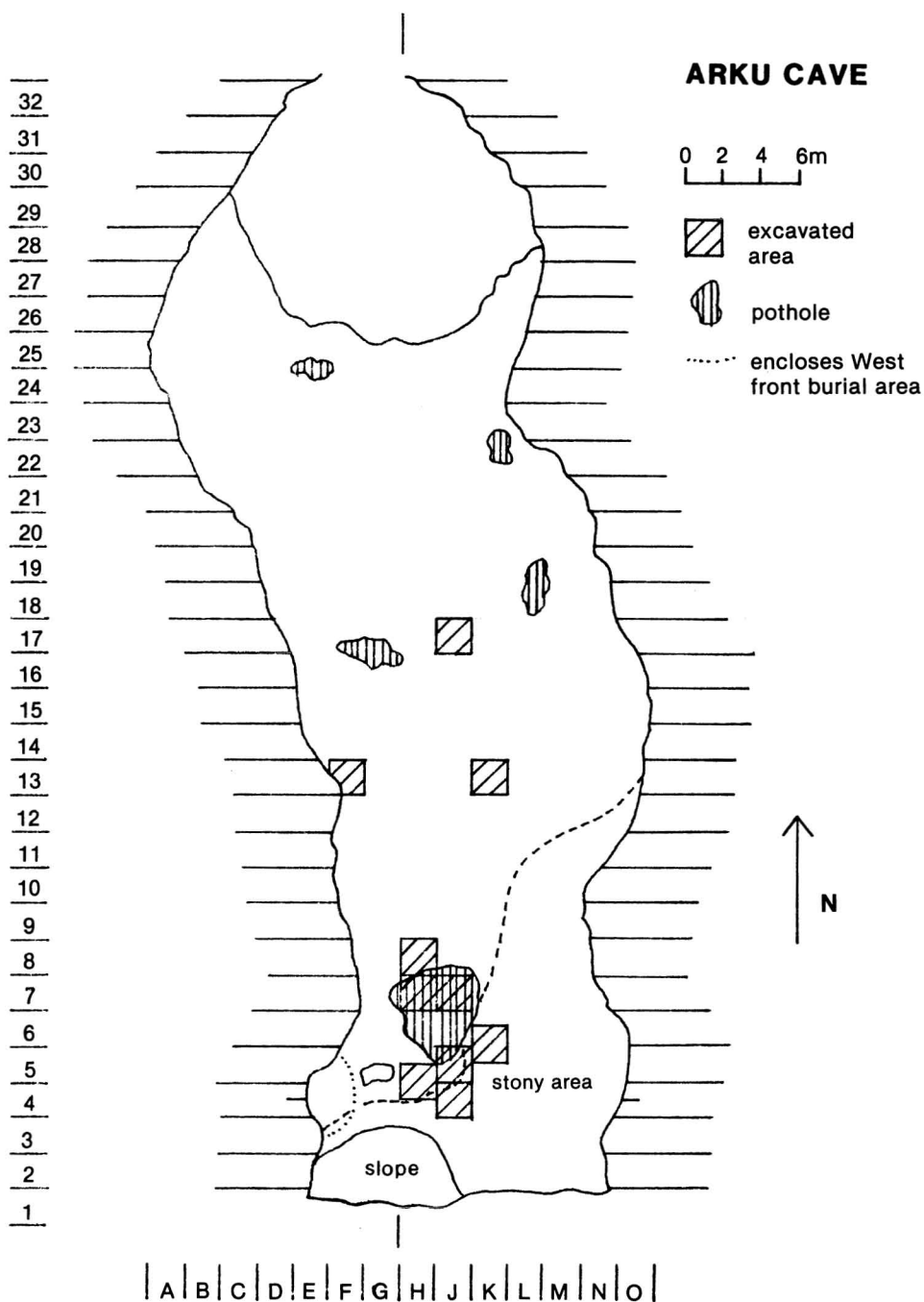


Fig. 2. Arku Cave floor plan.



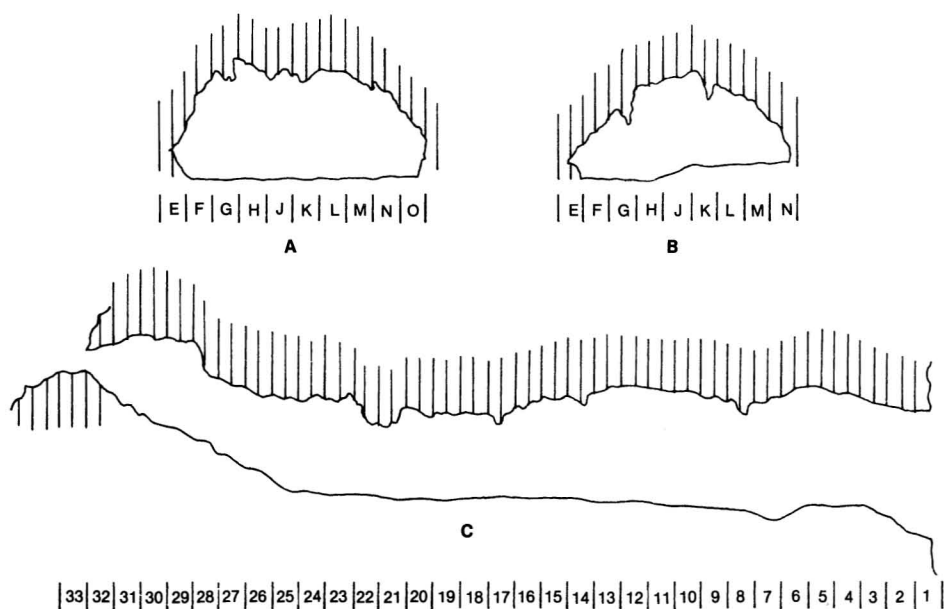


Fig. 3. Arku Cave cross sections: A at 13/14, B at center of 4, C at G/H.

The front of the cave is dry, but there is some water dripping from the ceiling in the central and back areas. The amount of dripping water varies with the amount of rainfall, but even after a five-day typhoon the front part of the cave, from the cave mouth back 14 m, was still perfectly dry.

There is some vegetation growing in the cave. In the central area there are some vines and moss growing on the floor and walls, and on large rocks. In the front area near the cave walls there are vines, and near the mouth are a few bushes and a small tree. There are trees and bushes growing on ledges on the near vertical cliff outside the cave mouth.

## THE EXCAVATIONS

### *Introduction*

I conducted excavations at Arku for nine weeks from September to November, 1976. I hired and trained two local men as excavators.

The cave floor was divided into a 2-m grid pattern on a north-south base line designated by numbers and letters. Nine 2-m squares and most of a tenth were excavated. The soil was very soft and there were a few cave-ins of excavated walls, so barks could not be left between squares. Natural soil layers were used as vertical control units, but the natural layers were divided into 15 or 20 cm arbitrary levels when their thickness exceeded 15 cm. All the soil was carefully excavated by trowel and screened through 1.5 mm screen.

The amount of cultural material on the surface varied from location to location within the cave. The entire front part of the cave, particularly the southeast stony area,

was littered with human bones and earthenware sherds. The central area, from 16 to about 38 m into the cave, had some sherds and bones on the surface but many fewer than in the front. The back of the cave had a few sherds on the surface, but this area was too dark to excavate without artificial lighting. Therefore, the excavations were confined to the front and central areas of the cave.

Four areas of the cave were delimited by natural features and the amount of cultural remains on the surface—the southeast stony area, the western part of the cave front, the central part of the cave, and the back of the cave. I decided to excavate in each of the three front areas to seek evidence of possible differential use of the cave.

In the central area of the cave there was much water on the surface (due to dripping from the ceiling) and also many large stones that could not be moved. It was therefore not feasible to excavate in certain squares. Four suitable squares were chosen for excavation.

The extreme west front 6-8 m of the cave slopes considerably toward the mouth of the cave, making this area somewhat dangerous; therefore it was not excavated. The selection of the square to be excavated in the west front area was limited by the presence of large stones and potholes. There was only one area suitable for excavation, and this was centered on an offset square, H4/5.

Selection of the squares in the southeast stony area was determined by a burial partially exposed by pothunting activities. I wanted to expose it further. It was located at the western edge of K on the 5/6 line, so an offset square, K5/6, was chosen. I also excavated square J5 adjacent to this. A burial in the southern part of J5 extended into J4, so I excavated the northern part of J4 to complete excavation of this burial. I would have liked to excavate further in this area, but I did not have sufficient time.

The pothunters left a considerable amount of loose back-dirt in the large pothole. We screened this dirt and found many human bones, earthenware sherds, and other artifacts. This pothole was approximately 1 m deep. After the dirt was screened and removed, the undisturbed lower portions of squares H7 and J7 were excavated.

### *Stratigraphy*

The cave sediments are a mixture of wind-blown soils, bat guano, weathered cave materials, and a small amount of disintegrating vegetation. The sediments have been subject to some water action and various natural chemical agents. There are three sediment types present on the surface of the cave.

In the southeast stony area, the west front, and the far back right of the cave is a soft grayish brown (10YR 5/2) or brown (7.5YR 5/2) sediment.

In the center and back left areas is a very dark grayish brown (10YR 3/2) sediment that is loose and coarse grained. This same sediment is present on the surface of most of the caves in the area. This dark sediment overlies lighter brown sediments of the same type that are present on the surface in the southeast, west front, and back of the cave, and therefore was deposited last. Since this dark sediment is also present in other caves in the area, it must be primarily wind-blown. Apparently, due to various features of the cave, it was only deposited in part of the cave; possibly it has been eroded or otherwise removed from the other areas. Because of this deposition sequence, the cultural materials in the lighter brown soils, even if not as deep, are undoubtedly older than those in the dark brown soil.

In the back central area (G-L 16-21) is a pale brown (10YR 8/3) soil that is very hard on the surface.

There are two distinct stratigraphic sequences in the cave. The main one is found in all the areas of the cave except the back central area. A stratigraphic profile of this sequence is given in Figure 4. The basic sediment seems to be primarily composed of wind-blown soil with bat guano; it is various shades of brown in most areas, with red shades in part of the central area. The red sediments are probably due to water and chemical action. They occur in many areas where there is water dripping from the ceiling, whereas there are none where there is no dripping water. There are various colors of red sediments in the layer—mostly dark reds, with each color gradually changing to another, both horizontally and vertically. The bottom of the layer was very dark reds. These color changes seem unrelated to the cultural sequence. Most of the layer was dark reddish brown (5YR 3/3 and 2.5YR 3/4), but there were also areas of dusky red (2.5YR 3/2), red (2.5YR 4/6 and 4/8), dark red (2.5YR 3/6), yellowish red (5YR 4/8 5/8 and 5/6), very dark reddish brown (2.5YR 2/4), and dark reddish brown (5YR 3/2).

The sequence in the west central area of the cave (F13) is similar to that in H8. J5 is similar to H4/5, with soft brown and yellowish-brown sediments but no reds. In the upper layer in the front part of the cave (brown 7.5YR 5/2), particularly in the south-east stony area, there is some organic debris, primarily leaves and twigs. There is also some organic debris in some of the lower levels.

In K5/6 the sequence is somewhat different. This square is in the southeast stony area and is on a slope. The eastern edge is 60 cm higher than the western edge, making the slope approximately 30°. The soil layers follow this slope. The surface of the square was almost covered with large (25-40 cm) stones. In between the stones was soft brown (7.5YR 5/2) sediment. The thickness of this sediment varies from 25 cm in the eastern part to 15 cm in the western part. Below this layer is a light yellowish-brown (10YR 6/4) sediment 20-30 cm thick and below it is a layer of gray ashy soil 10-15 cm thick. There were a few very small pieces of charcoal and considerable quantities of ash, which made the layer gray, varying from light gray (10YR 7/1), to darker shades, to grayish brown (10YR 5/2). Some of the ash was from bamboo. There were many identifiable strands of bamboo that were not totally consumed into ash. Below this ash layer was a very pale brown (10YR 7/4) sediment with large and small stones, below which was all stone.

The ash layer is problematical and deserves further comment. It extends into the north, east, and south walls of K5/6 and phases out in the eastern part of J5. There is also an ash layer present in the eastern wall of the large pothole, so the ash layer covers a fairly large area. It does not seem to be related to any of the cultural features of the cave and is possibly a result of natural burning of vegetation and guano that was blocked in some areas by large stones and to the north by wet soil.

The stratigraphy in the east central area of the cave seems unrelated to that in the other areas. The surface of this area, including J17, is very pale brown (10YR 8/3). The surface itself is quite hard, but below the surface the soil is very soft (someone stepping on it sinks about 15 cm) down to about 65 cm. This square has mottled sediment. The upper 10-15 cm is very pale brown (10YR 8/3) with some patches of light brownish gray (10YR 6/2) and very dark gray (10YR 3/1). Below this it becomes much more mottled. There are intermixed patches of very pale brown (10YR 8/3), light grayish brown (10YR 6/2), very dark gray (10 YR 3/1), gray (10YR 5/1), and yellowish

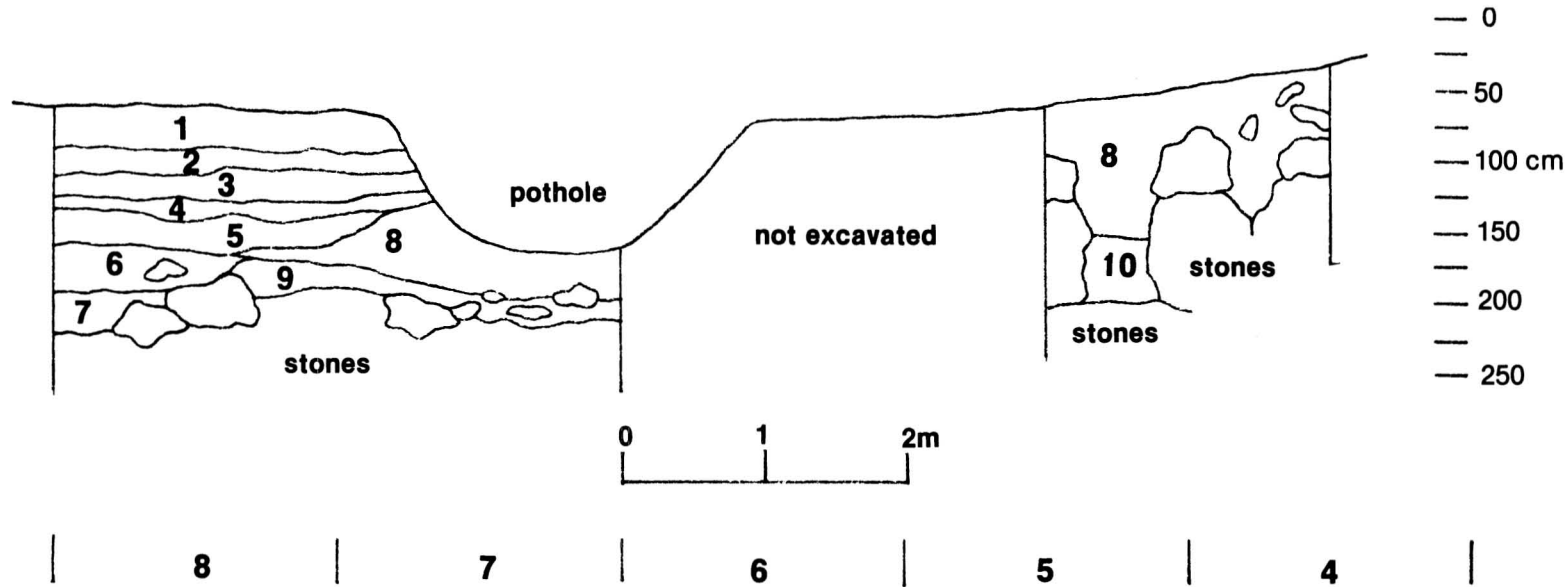


Fig. 4. Stratigraphic profile at G/H. Layers 1-10 as follows: **1**, very dark grayish brown 10YR 3/2; loose, coarse-grained sediment; no cultural remains. **2**, dark grayish brown 10YR 4/2; loose, coarse-grained sediment; a few earthenware sherds. **3**, brown 10YR 5/3; very soft, fine-grained sediment; many earthenware sherds. **4**, dark red 2.5YR 3/6; very soft, fine-grained sediment; human bone and earthenware sherds. **5**, dark reddish brown 2.5YR 3/4; very soft, fine-grained sediment mixed with many chunks (1-5 cm) of hard black sediment; earthenware sherds and human bone. **6**, dark reddish brown 2.5YR 3/4; soft, fine-grained sediment; human bone and earthenware sherds; some stones (10-50 cm). **7**, very dark reddish brown 2.5YR 2/4; soft, fine-grained sediment; a few earthenware sherds; many stones (10-75 cm). **8**, brown 7.5 YR 5/2; very soft, fine-grained sediment; many earthenware sherds and human bones; some stones (10-75 cm). **9**, yellowish brown 10YR 5/4; soft, fine-grained sediment, but with many small (0.5-10 cm) and larger (10-100 cm) stones; a few earthenware sherds and human bones. **10**, very pale brown 10YR 7/4; soft, fine-grained sediment, but with many small (0.5-10 cm) and larger (10-75 cm) stones; a few earthenware sherds and human bones.

brown (10YR 5/6). The colors are in small patches of 1–2 cm to larger ones of 8–10 cm. There is no pattern to the arrangement of colors, but in profile some horizontal bedding lines several cm thick can be seen in some parts. From a depth of 65 to 95 cm the mottled pattern continues, but the sediment changes from the very soft consistency to a more normal consistency. The mottled pattern may be partly caused by water action and disintegrating limestone. It seems unrelated to the cultural material in the square. Below this is a 60 cm layer of hard dark brown (10YR 4/3) sediment mixed with large and small stones.

The sediment profile in F13 is similar to that in H8. In K13 is a transition between the two main stratigraphic sequences in the cave, with sediments relating to both sequences present in various parts of the square.

### *The Burials*

The front part of the cave (from the cave mouth back 16 m) was heavily used; the majority of cultural remains were excavated in this area. In the central and back areas of the cave there were very few cultural remains; this area does not seem to have been used to any great extent. This is possibly because this area of the cave is very wet much of the time and also dark, whereas the front part is always dry and well-lit.

None of the cultural materials excavated indicate that the cave was ever used for habitation. Its primary use seems to have been for burials. Several different styles of burials were excavated, but all were secondary burials and the bones were generally scattered. Although I was able to distinguish different styles of burials, because of their scattered nature I generally could not determine exactly which bones were from a particular individual, or which artifacts were associated with them. In the following descriptions the burials are discussed by area or grouping, and the associated artifacts are given to the extent that they could be determined. Much of the burial information, such as the number of bones, sherds, and other common items, is given in Table 1. Only the more important items are given in the burial descriptions, so the reader should refer to Table 1 while reading this section, and also to the stratigraphy section for more detailed descriptions of the sediments.

#### K5/6

K5/6 is in the southeast stony area of the cave. On the surface of this entire stony area including K5/6 were many human bone fragments and potsherds. Many large (25–40 cm) stones were first removed from the surface. There were stones throughout the various layers in the square but not as many as on the surface. Sediment Layer I (brown 7.5YR 5/2) contained sherds, beads, bracelets, one jade earring (Fig. 5r), and bones. All of the bone from this layer is fragmentary except for a few small bones that are whole. These bones are from at least three, possibly four people. (A discussion of how numbers of people were determined is given in a later section of the paper.) The bones are too fragmentary to obtain identification of sex, but there is some indication of age. There are four skull fragments with sutures that have begun to close, indicating an older adult. There is a mandible with no teeth, the tooth sockets for the molars have been reabsorbed, indicating an older person. There are also seven child bones from at least two children, and ten infant bones. Fifty-five percent of the bones in this layer are burned from cremation.

Layer II in K5/6 is a light yellowish-brown (10YR 6/4) sediment. This layer contained sherds, a nearly complete small, globular pot (Fig. 13i), 5801 bones and frag-

TABLE 1. LOCATION OF EXCAVATED MATERIALS

|                              | THICKNESS (cm) | ADULT HUMAN BONES<br>AND FRAGMENTS | NUMBER OF<br>ADULT BURIALS | SHERDS | WHOLE POTTERY<br>VESSELS | SHELL AND<br>STONE BEADS | FRAGS OF<br>SHELL BRACELET | FLINT FLAKES | SPINDLE WHORL | BONE POINT | FIRE CLAY EARRING | SHELL EARRING | STONE EARRING | JADE EARRING | OTHER  |
|------------------------------|----------------|------------------------------------|----------------------------|--------|--------------------------|--------------------------|----------------------------|--------------|---------------|------------|-------------------|---------------|---------------|--------------|--|
| K5/6                         |                |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |  |
| Layer I: brown               | 15-25          | 1321                               | 4                          | 420    |                          | 59                       | 2                          |              |               |            |                   |               |               | 1            |  |
| Layer II: lt yellowish brown | 20-30          |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |  |
| jar burial                   |                | 347                                | 2                          | 76     |                          |                          |                            |              |               |            |                   | 1             |               |              |  |
| next to jar                  |                | 159                                | 2                          |        |                          | 12                       |                            |              |               |            |                   |               |               |              |  |
| NW of jar                    |                | 312                                | 2                          |        |                          |                          |                            |              |               |            |                   |               |               |              |  |
| SW area                      |                | 781                                | 3                          | 107    |                          | 18                       | 3                          | 1            |               |            | 4                 | 2             |               |              | 124 skull frags in pot (21 sherds), 3 adzes, cowrie shell, 4 tattoo chisels, 68 drilled animal teeth |
| remainder of layer           |                | 4204                               | 6                          | 135    | 1                        | 2                        |                            | 1            |               |            | 8                 | 7             | 2             |              |  |
| Layer III: ashy soil         | 10-15          |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |  |
| NE pit                       |                | 308                                | 2                          |        |                          |                          |                            |              |               |            |                   |               |               |              |  |
| SE pit                       |                | 95                                 | 1                          | 12     |                          |                          |                            |              |               |            |                   |               |               |              |  |
| rest of layer                |                | 58                                 | 1                          | 16     |                          |                          |                            |              |               |            |                   |               |               |              |  |
| Layer IV: v pale brown       | 20-50          | 4                                  |                            | 1      |                          |                          |                            |              |               |            |                   |               |               |              |  |
| J5                           |                |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |  |
| Layer I: brown               | 50-90          | 1969                               | 3                          | 526    |                          | 15                       | 6                          | 7            |               |            | 3                 |               | 1             |              | 3 drilled an teeth, an tooth pend.   |
| overlying south burial       | 35             | 1296                               | 3                          | 317    |                          | 8                        |                            |              |               |            |                   |               | 2f            |              |  |
| S burial                     | 15             | 1454                               | 5                          | 188    | 1                        | 29                       | 5                          |              | 1             | 1          |                   |               |               |              | Red ocher, bamboo w/red ocher  |

TABLE 1. *Continued.*

|                             | THICKNESS (cm) | ADULT HUMAN BONES<br>AND FRAGMENTS | NUMBER OF<br>ADULT BURIALS | SHERDS | WHOLE POTTERY<br>VESSELS | SHELL AND<br>STONE BEADS | FRAGS OF<br>SHELL BRACELET | FLINT FLAKES | SPINDLE WHORL | BONE POINT | FIRE CLAY EARRING | SHELL EARRING | STONE EARRING | JADE EARRING | OTHER   |
|-----------------------------|----------------|------------------------------------|----------------------------|--------|--------------------------|--------------------------|----------------------------|--------------|---------------|------------|-------------------|---------------|---------------|--------------|---|
| H4/5                        |                |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |   |
| Layer I: brown              | 112            |                                    | 10                         |        |                          |                          |                            |              |               |            |                   |               |               |              |   |
| level 1: 0-20 cm            | 20             | 674                                |                            | 505    |                          | 3                        | 27                         | 3            |               | 2          | 1,2f              |               |               |              | Wood awl, frag <i>Conus</i> shell<br>disc                 |
| level 2: 20-40 cm           | 20             | 665                                |                            | 461    |                          | 6                        | 4                          | 2            | 1             | 5          | 1,3f              |               |               |              | Fired clay disc   |
| level 3: 40-60 cm           | 20             | 773                                |                            | 406    |                          | 5                        | 6                          |              |               | 2          |                   |               | 1             |              | Rope, wood bead   |
| level 4: 60-80 cm           | 20             | 645                                |                            | 654    |                          | 7                        |                            |              | 1             |            |                   |               |               | 1            | Barkcloth beater, charred<br>bamboo                       |
| level 5: 80-100 cm          | 20             | 443                                |                            | 174    | 1                        | 3                        |                            |              | 1             |            |                   |               |               |              | Bone awl  |
| level 6: N half, 100-112 cm | 12             | 102                                |                            | 47     |                          | 1                        |                            | 1            |               |            | 1f                |               | 1f            |              |   |
| Layer II: v pale brown      | 48             | 11                                 |                            | 8      |                          |                          |                            |              |               |            |                   |               |               |              |   |
| West front burial area      |                | 379                                | 2                          | 185    |                          | 62                       | 3                          |              |               |            |                   | 2f            |               |              |   |
| Backdirt in large pothole   |                | 1855                               | 6                          | 2160   |                          | 3                        | 91                         | 6            | 2             | 1          | 18f               | 1             | 1             |              | Bone bead, 3 <i>Conus</i> shell<br>ornaments, 5 bone awls |
|                             |                |                                    |                            |        |                          |                          |                            |              | 5f            |            |                   |               |               |              |   |
| H7 (below pothole)          |                |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |   |
| brown, 90-115 cm            | 25             | 14                                 |                            | 39     | 1                        |                          |                            |              |               |            |                   |               |               |              |   |
| J7 (below pothole)          |                |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |   |
| brown, 80-103 cm            | 23             | 15                                 |                            | 32     |                          |                          |                            |              |               |            |                   |               |               |              |   |
| H8                          |                |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |   |
| Layer I: v dk grayish brown |                |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |   |
| 0-24 cm                     | 24             |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |   |
| 24-48 cm                    | 24             | 1                                  |                            | 13     |                          |                          |                            |              |               |            |                   |               |               |              |   |
| Layer II: brown, 48-58 cm   | 10             | 13                                 |                            | 299    |                          |                          |                            |              |               |            |                   |               |               |              |   |

TABLE 1. *Continued.*

|                                    | THICKNESS (cm) | ADULT HUMAN BONES<br>AND FRAGMENTS | NUMBER OF<br>ADULT BURIALS | SHERDS | WHOLE POTTERY<br>VESSELS | SHELL AND<br>STONE BEADS | FRAGS OF<br>SHELL BRACELET | FLINT FLAKES | SPINDLE WHORL | BONE POINT | FIRE CLAY EARRING | SHELL EARRING | STONE EARRING | JADE EARRING | OTHER               |
|------------------------------------|----------------|------------------------------------|----------------------------|--------|--------------------------|--------------------------|----------------------------|--------------|---------------|------------|-------------------|---------------|---------------|--------------|---------------------|
| Layer III: red                     |                |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |                     |
| 58-80 cm                           | 22             | 3                                  |                            | 156    | 1                        |                          |                            |              |               |            |                   |               |               |              |                     |
| 80-96 cm                           | 16             |                                    |                            | 84     |                          |                          |                            |              |               |            |                   |               |               |              |                     |
| 96-119 cm                          | 23             |                                    |                            | 18     |                          |                          |                            |              | 1             |            |                   |               |               |              |                     |
| SE bone area, 80-90 cm             | 10             | 486                                | 1-2                        | 48     | 1                        |                          |                            |              |               |            |                   |               |               |              | Pieces of red ocher |
| F13                                |                |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |                     |
| Layer I: v dk gr brown, 0-5 cm     | 5              |                                    |                            | 1      |                          |                          |                            |              |               |            |                   |               |               |              |                     |
| Layer II: brown/yell-brown, 5-8 cm | 3              |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |                     |
| Layer III: red, 8-44 cm            | 36             |                                    |                            |        | 1                        |                          |                            |              |               |            |                   |               |               |              |                     |
| Layer IV: yell-brown, 44-168 cm    | 124            |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |                     |
| K13                                |                |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |                     |
| Layer I: v dk gray-brown, 0-15 cm  | 15             |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |                     |
| Layer II: mottled                  |                |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |                     |
| level 1: 15-30 cm                  | 15             |                                    |                            | 12     |                          |                          |                            |              |               |            |                   |               |               |              |                     |
| level 2: 30 to 38-68 cm            | 8-38           |                                    |                            | 1      |                          |                          |                            |              |               |            |                   |               |               |              |                     |
| J17 mottled                        |                |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |                     |
| level 1: 0-15 cm                   | 15             | 3                                  |                            | 10     |                          |                          |                            |              |               |            |                   |               |               |              |                     |
| level 2: 15-30 cm                  | 15             | 11                                 |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |                     |
| level 3: 30-50 cm                  | 20             |                                    |                            |        |                          |                          |                            |              |               |            | 1                 |               |               |              |                     |
| level 4: 50-65 cm                  | 15             | 3                                  |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |                     |
| level 5: 65-85 cm                  | 20             |                                    |                            | 2      |                          |                          |                            |              |               |            |                   |               |               |              |                     |
| level 6: 85 to 87-99               | 2-14           |                                    |                            |        |                          |                          |                            |              |               |            |                   |               |               |              |                     |

Note: f following a number = fragment



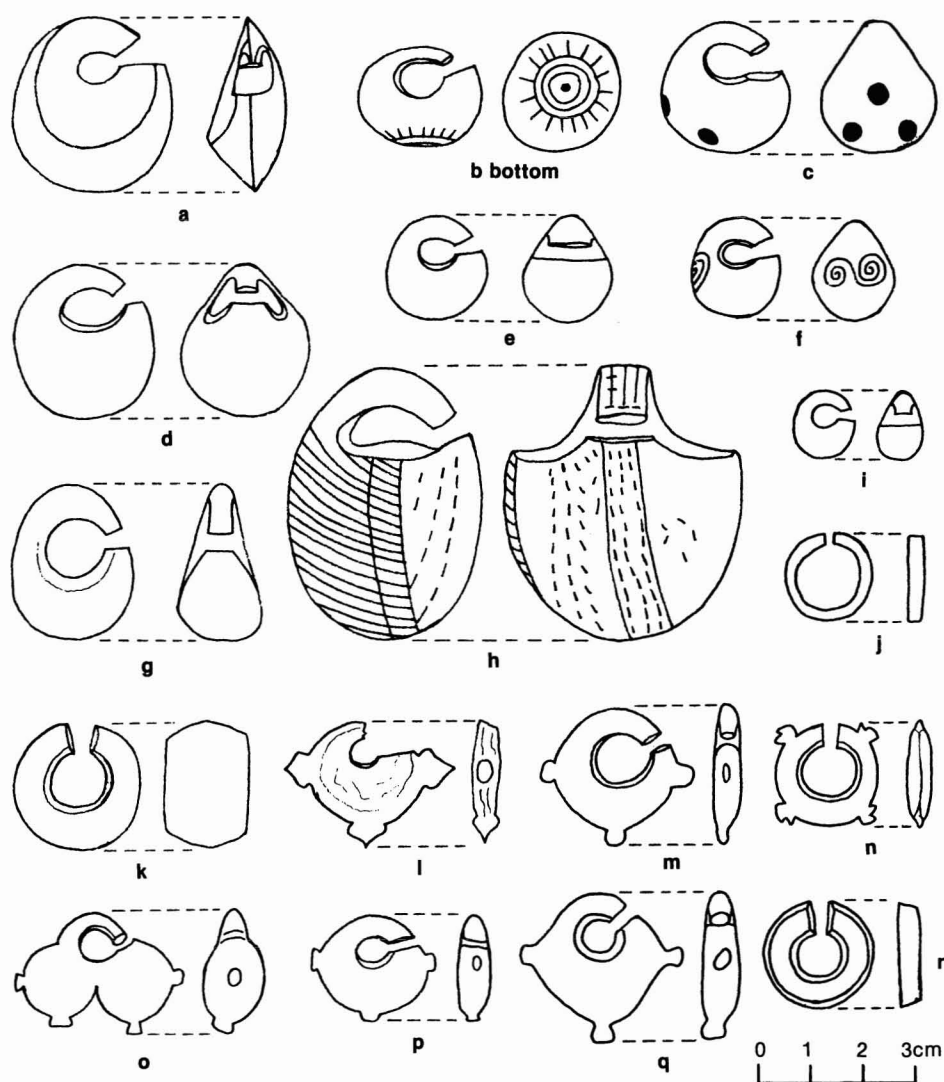


Fig. 5. Earrings. *a-i*, fired clay (*b,f,h* with incised decorations; *c* with punctations 3-4 mm deep); *j-m*, stone (1 broken); *n-q*, shell; *r*, jade.

ments, and numerous grave goods. This layer contained four different types of burials. In the extreme north central part of the square and extending into K6/7 was a jar burial. The jar was broken, though most of the sherds were more or less in place. The jar burial consisted of parts of two pots. There were sherds of a red-slipped pot 4-6 mm thick. The diameter of the body was between 30 and 35 cm. No rim sherds were present. There were sherds of a second red-slipped pot, 8-10 mm thick. The sherds of the thinner pot were inside those of the thicker one. There were bones from two adults inside the jar. Forty-two percent of these bones are burned. Inside the jar with the bones was one shell earring (Fig. 5*q*).

TABLE 2. RADIOCARBON DATES

| LAB NO. * | SQUARE | SOIL<br>LAYER<br>(FIG. 4) | DEPTH<br>FROM<br>SURFACE | UNCORRECTED<br>DATE B.P. **                                 | CALIBRATED<br>DATE *** | TWO-SIGMA RANGE   |
|-----------|--------|---------------------------|--------------------------|---|------------------------|-------------------|
| ISGS-495  | H8     | 5                         | 84 cm                    | 2460 $\pm$ 80   | 600 B.C.               | 805-390 B.C.      |
| GaK-7038  | K5/6   | 8                         | 32 cm                    | 2010 $\pm$ 90   | 75 B.C.                | 370 B.C.-A.D. 220 |
| GaK-7041  | K5/6   | 8                         | 40 cm                    | 3040 $\pm$ 130  | 1275 B.C.              | 1660-890 B.C.     |
| GaK-7039† | K5/6   | 8                         | 52 cm                    | 6300 $\begin{smallmatrix} +1600 \\ -1300 \end{smallmatrix}$ | 4540 B.C.              | 7740-1940 B.C.    |
| GaK-7042  | J5     | 8                         | 48 cm                    | 2390 $\pm$ 160  | 490 B.C.               | 805-170 B.C.      |
| GaK-7040  | H4/5   | 8                         | 62 cm                    | 2740 $\pm$ 120  | 935 B.C.               | 1225-645 B.C.     |

Note: All dates are on charcoal.

\*GaK = Gakushuin University; ISGS = Illinois State Geological Survey.

\*\*Uncorrected dates are based on Libby half-life of 5568 years.

\*\*\*Calibrated dates are according to Klein et al. (1982). Klein et al. give two sigma ranges. The single calibrated dates given above are halfway between the two sigma range dates.

†This date is possibly not accurate (see text).

Right next to the jar to the southeast was an area of bones and ash. The bones are from two adults. There were also beads in this area. All the skull bones and fragments from these two associated areas were inside the jar. To the northwest of the jar, separated horizontally by 25 cm of sterile sediment, was another area of bones from at least two adults, and some ash. This area may or may not be associated with the jar burial. If it is associated, then the bones are from at least four people.

In the southwestern area of this square was another burial with a pot. There were body sherds of a round-bottomed red-slipped pot with a carinated shoulder and narrow neck, but no rim sherds were present (Fig. 9c). Inside the pot were skull fragments and a few other bones. The skull has a heavy brow ridge and heavy glabella and nuchal areas, and very open sutures, so it is probably from a very young adult male. Seventy percent of the bones in the pot are burned. In and near the pot were pieces of charcoal. Charcoal from inside the pot (at a depth of 52 cm) has been dated to 4540 B.C. (GaK-7039) (calibrated date, see Table 2). Because this date was so odd and so early compared to the others (see below), I checked with the dating laboratory. The large error is due to the small amount of carbon in the sample, and the date was obtained by dilution with carbon of known date. This date is much earlier than its stratigraphic relation to other dates (given below) and its artifactual associations would indicate. The processing technique may have produced an error in the determination, or an error may be due to another cause. However, since this date has such a large error, the two-sigma range can place it as late as 1940 B.C., which is a reasonable date when compared with the others. But since this date does have such a large error (7740-1940 B.C.), it does not provide any useful information on the age of the site.

Near this pot in a 60  $\times$  90 cm area were bones that seem to be from three individuals. Bones of one group look like they are from a robust young adult, and are probably from the person whose skull was in the pot. Bones of a second group look like they are from a small elderly person, probably female (based on size of bones and skull morphology), and those of the third group are from a 11-14-year-old child. Skull fragments from this

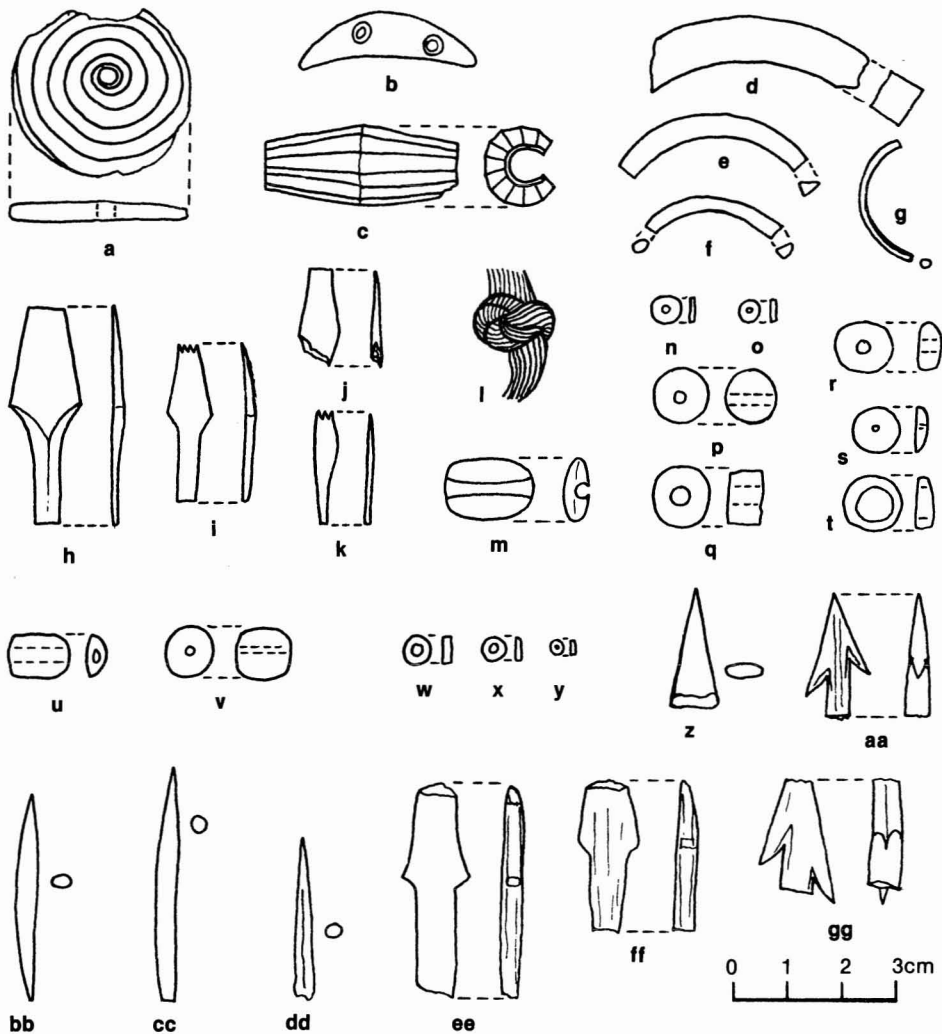


Fig. 6. Excavated artifacts. *a*, *Conus* shell ornament; *b*, drilled animal canine tooth; *c*, faceted wood bead; *d-f*, shell bracelet fragments; *g*, fragment of shell ring; *h-k*, tattooing chisels (?); *l*, rope; *m*, shell bead; *n-o*, small shell beads; *p-t*, large shell beads; *u*, shell bead; *v*, bone bead; *w-y*, stone (shale) beads; *z*, horn point; *aa*, *gg*, barbed bone points; *bb*, wood awl; *cc*, *dd*, bone awls; *ee*, *ff*, blunted bone points.

individual have porotic hyperostosis (discussed below). Associated with this group of burials were sherds, 2 ground stone adzes and 2 pieces of a third adze (Fig. 7*b*, *i*), earrings (Fig. 5*c*, 5*o*; also 3 of type shown in Fig. 5*d*, 1 of type shown in Fig. 5*p*), beads, 1 flint flake, 1 cowrie shell, bracelets, 4 objects made of horn that are possibly tattooing chisels (Fig. 6*h-k*), and 68 drilled animal teeth and fragments (Fig. 6*b*). The western edge of this burial area had been exposed by a pothole, so all the materials originally associated with it may not have been present at the time of excavation.

In the remainder of the second sediment layer in K5/6 were 4204 bones and fragments, scattered throughout the square in no apparent pattern. The bones are from at least ten people—six adults, one adolescent, one child, one young child, and one infant.

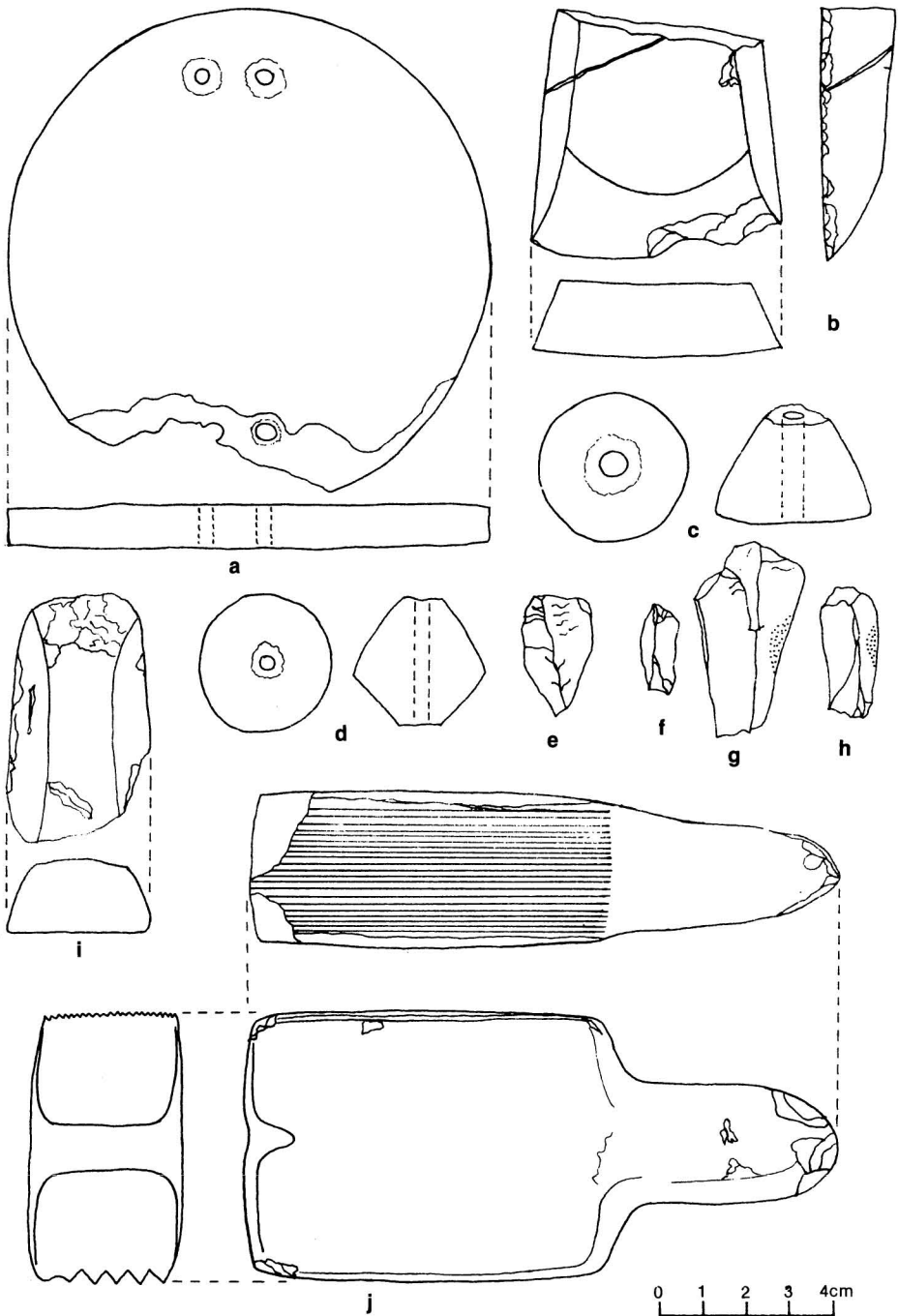


Fig. 7. Excavated artifacts. *a*, red-slipped fired clay disc; *b, i*, trapezoidal ground stone adzes; *c, d*, spindle whorls; *e-h*, flake tools (*e*, woodworking; *f*, animal butchering; *g, h*, grass reaping [stipling shows areas of sheen]); *j*, sandstone barkcloth beater.

Seventeen percent of this bone is burned. In this layer were also found sherds, an almost whole ring-footed pot (Fig. 13i), 1 flint flake, beads, 1 chert earring (of the type in Fig. 5m), 1 shale earring (Fig. 5m), 7 shell earrings (Fig. 5p, plus 5 others and 1 fragment of the same type), and 8 fired-clay earrings (Fig. 5b, e, f; also 1 of type shown in Fig. 5d). Four of the fired-clay earrings are very small (Fig. 5i) and are probably from the infant and young child burials. There was also some charcoal in this layer. Charcoal from a depth of 32 cm has been dated to 75 B.C. (GaK-7038), and a sample from 40 cm is dated to 1275 B.C. (GaK-7041).

With the exception of the specific areas already mentioned, the bones in this layer were scattered throughout the square with no apparent pattern. There were some areas where bones and sherds were more concentrated. There are also many bones scattered on the surface of the cave in this same seemingly random way. At the time of burial, bones or bones with or in a pot could have been neatly placed in one area. They could have been disturbed later, possibly by the many stones that have fallen from the ceiling or by later human activity. The area is also subject to frequent earthquakes and tremors.

Layer III in K5/6 is the ashy soil. This layer produced few remains; most of these were in two pits. In the northeastern corner was a pit approximately 25 cm deep. In this pit was ash, some charcoal, and 308 bone fragments, 65 percent of which are burned. These bones are from at least two adults, and there are also four child bones. In the southeastern area of the square was a smaller pit with sherds and bone fragments, most of them burned. One is a child bone, the rest are probably from one adult. In the rest of the layer were 60 bone fragments, including two child bones; 16 sherds were scattered throughout the square.

Layer IV in K5/6 is very pale brown (10YR 7/4) sediment with many small and large stones. The base of this layer, which varied from 55 to 135 cm below the surface, was all stone. In the upper part of the layer were four bones and one potsherd.

## J5

Square J5 is directly to the southwest of K5/6. Part of the central and southern areas of the square had been dug away as part of a pothole. In the extreme southern part of the square was a burial area that had been exposed by the pothole and could be seen in cross section. From the surface to a depth of 35 cm was soft brown (7.5YR 5/2) sediment. From 35–40 cm was a layer of ash, much of it bamboo ash with some bamboo charcoal. Below this was a 15-cm layer with many bones, sherds, and pieces of charcoal. Below this was very pale brown (10YR 7/4) sediment.

I excavated the sediment overlying the burial area. In it were 1296 bones (40 percent burned) from at least three adults, 12 bones from a young adolescent, sherds, and beads.

The burial area itself extended 40 cm south in J5 and 60 cm south into J4. The area was approximately 60 cm wide, being blocked on the east and west by very large stones that were there at the time of burial. In the burial area were 1454 bones and fragments. Thirty-eight percent are burned, 32 percent are not, and 30 percent are heavily covered with red ocher. There were also some pieces of bamboo covered with red ocher and some pieces of red ocher in the area. The bones are from four or five adults. Also in the burial area were sherds, beads, bracelets, a spindle whorl (type shown in Fig. 7c), and a horn point (Fig. 6z). At the southern end of the burial was a whole, small, red-slipped stemmed vessel with three equally spaced sets of an incised decoration on the stem (Fig. 8b). Charcoal from this burial area has been dated to 490 B.C. (GaK-7042). Below the burial is very pale brown (10YR 7/4) sediment with stones and no cultural remains.

In the remainder of J5, to the north of the burial area just discussed, was Layer I: brown (7.5YR 5/2) sediment, that varied from 50 cm thick in the eastern part of the square to 90 cm thick in the western part. The light yellowish-brown (10YR 6/4) and gray ashy sediments present in K5/6 lens out in the eastern part of J5. In this brown layer were bones from at least three adults; 38 percent of this bone is burned. Also present in this area were 11 child bones, sherds, beads, a ground chert earring (Fig. 5j), bracelets, three fired-clay earrings (type shown in Fig. 5e), three drilled animal teeth, two fragments of a ground stone earring, five fragments of an animal tooth pendant, and seven flint flakes. In several areas in this layer sherds were somewhat concentrated and were associated with bones. These may have been jar burials or bones placed with a pot that were later disturbed. Below this brown layer is Layer II: very pale brown (10YR 7/4) sediment with stones and no cultural remains.

#### H4/5

Square H4/5 also contained burials. Bones from at least ten adults and one child were recovered. Layer I of this square is soft brown (7.5YR 5/2, sediment that extends from the surface to a depth of 112 cm. This was excavated in 20 cm levels. In level 1 were 674 bones (39 percent burned), two child bones, sherds, a fired-clay earring (type shown in Fig. 5g), two fragments of fired-clay earring, three flakes, beads, a fragment of a shell disc, bracelets, two bone points (Fig. 6gg and one like type shown in Fig. 6ff), and a wood awl (Fig. 6bb).

Level 2 contained 665 bones (43 percent burned), sherds, a spindle whorl (type shown in Fig. 7c), a red-slipped fired-clay disc (Fig. 7a), five bone points (Fig. 6ee, ff, and two of type shown in Fig. 6aa), earring fragments, beads, bracelets, two flakes, and a fired-clay earring (type shown in Fig. 5g).

Level 3 had 773 bones (36 percent burned), four child bones, sherds, a piece of knotted rope made from a vine (Fig. 6l), a shale earring (Fig. 5l), a large faceted wood bead (Fig. 6c), two bone points (types 6ee, ff), bracelets, and beads. Level 4 contained 645 bones (38 percent burned), six child bones, sherds, a spindle whorl (type shown in Fig. 7c) at -78 cm, a ground sandstone barkcloth beater (Fig. 7j) at -74 cm, a jade earring (type shown in Fig. 5r), beads, and a piece of charred bamboo. At a depth of 62 cm there was an ashy area with some charcoal and a few bones. This charcoal has been dated to 935 B.C. (GaK-7040). Several skull bones from levels 2, 3, and 4, which could be from the same person, were stained red. This was probably produced by soaking in or applying a solution made with red ocher.

Level 5 contained 443 bones (41 percent burned), one child bone, sherds, a small bowl (Fig. 11i), a bone awl, a point made from horn or bone, and beads.

Only the northern half of level 6 was excavated because there were many large stones in the southern half. In this level were 102 bones (42 percent burned), sherds, one fragment of a fired-clay earring, one fragment of a stone earring, one small shell bead, and one flint flake.

While level 6 was being excavated part of the north wall of the square caved in (due to the very soft soil). We screened this soil separately and found 136 bones, 28 sherds, a large fired-clay earring with incised decoration (Fig. 5h), a spindle whorl (type shown in Fig. 7d), and a stone earring (Fig. 5k). These materials could have come from any of the six levels.

Below level 6 was Layer II of the square. This was a soft, very pale brown (10YR 7/4) sediment with many small (0.5-10 cm), large, and very large stones. Between the

large stones the sediment continued to a depth of 160 cm. In the upper 20 cm of this layer (112–132 cm) were 11 bones and 8 sherds.

#### WEST FRONT BURIAL AREA

In the southwest wall of the cave (at 3–5, see Fig. 2) there was a ledge 57–68 cm above the cave floor. The ledge was about 3 m long and 75 cm wide for most of its length. On this ledge and on the floor directly to the east of the ledge were bones and various artifacts. This area is called the west front burial area. It contained 379 bones (64 percent burned), five child bones, sherds, shell beads, three small green shale beads, one large oval shell bead (Fig. 6*m*), bracelets, and earring fragments. The bones from this area are from at least two adults and one child.

#### LARGE POTHOLE, H7, J7

The area of the large pothole is also in the front part of the cave. The pothole is approximately 6 m by 4 m and 1 m deep. There was some loose sediment (backdirt) in the hole that we screened. Although the pothunters undoubtedly took many of the artifacts that were originally in this area, there were still many artifacts in the backdirt. There were many bones and sherds and one shell earring (Fig. 5*n*), one chert earring (type shown in Fig. 5*p*), 3 *Conus* shell ornaments (one covered with red paint) (Fig. 6*a*), 5 bone awls (Fig. 6*cc*), one bone point (type shown in Fig. 6*aa*), a large oval shell bead (Fig. 6*ν*), two small shale beads, five fragments of spindle whorls, two spindle whorls (types shown in Fig. 7*c*, *d*), earring fragments, bracelets, and six flint flakes.

After the loose backdirt in the large pothole was screened and cleared out, the undisturbed sediment of squares H7 and J7 were excavated. Excavation level 1 in H7 was 90–115 cm. The sediment was brown (7.5YR 5/2) and soft. It contained bones and sherds. At 111 cm there was a small, whole, red-slipped carinated pot 12.5 cm tall with a rim diameter of 11.2 cm (Fig. 8*i*). Below 115 cm is yellowish-brown (10YR 5/4) stony sediment with no cultural remains.

Level 1 in J7 was 80–95 cm. The sediment was brown (7.5YR 5/2) and soft. It contained bones and sherds. Level 2, from 95–103 cm, was also brown and contained five bones. Below this the sediment was yellowish brown and stony as in H7 and contained no cultural remains.

#### H8

The central area of the cave also had burials, but not nearly as many as in the front of the cave. H8 was one square that had a burial area. A simplified stratigraphic profile is given in Figure 4.

Layer I in this area is the very dark grayish-brown (10YR 3/2) sediment, and is present from the surface to a depth of 48 cm. Toward the bottom of the layer it gets slightly lighter (dark grayish brown 10YR 4/2). No cultural remains were found from 0–24 cm. From 24–35 cm there were two sherds and one bone, and from 35–48 cm 11 sherds were found.

Layer II (48–58 cm) sediment was brown (10YR 4/3 and 5/3) in the south and gradually changed to yellowish brown (10YR 5/4) in the north. This is slightly more yellow than the brown (7.5YR 5/2) sediment in the front of the cave but has the same very soft consistency. In this layer were bones and sherds. One sherd is incised with circles (like those shown in Fig. 14*e*), and one flat sherd has a woven mat impression.

Layer III is the red layer, which goes from 58 to 100–119 cm. This sediment had the



same very soft consistency as Layer II, but in a few areas there were pieces and lenses of hard black lumps (1-5 cm) of sediment. Some areas were ash. At c. 85-90 cm the southern part of the square changed to brown (7.5YR 5/2), and by 95 cm it became yellowish brown (10YR 5/4) and not as soft as the other soils in the square. Throughout the square there were large and small stones, which increased in number with increased depth. By 100-119 cm, the entire square was covered with stone.

Layer III had some bone and other artifacts. In the upper 22 cm (58-80 cm) were three bone fragments and 156 sherds. In the southeastern part of the square from c. 63-72 cm was an ashy area c. 30 × 50 cm. Directly under this ashy area was an area of very small bone fragments and a few sherds; at the southern edge was a small footed bowl (type shown in Fig. 11a) at 75 cm. From c. 80-90 cm this bone area increases in size to the north, covering an area of 30 × 70 cm in the eastern part of the square and continuing into the east wall. The bone area is blocked to the north and west by large stones that were there at the time of burial. In this area were 48 sherds, 486 bones and fragments (300 of which are very small fragments), and some pieces of red ocher. Many of the bones were stained with red ocher.

In the southeastern part of this bone area was some ash and charcoal. Charcoal at 84 cm was dated to 600 B.C. (ISGS-495). In the northeastern part of the area at 83 cm was a whole, very small, stemmed pot (Fig. 8a). On the stem of this pot are 123 small, curved incised lines that were made with a fingernail. In the pot were bone fragments and some pieces of red ocher. Directly around the pot were many pieces of red ocher, and bones in this area were heavily covered with red ocher. Because most of the bones are very small, it is difficult to tell how many people are represented. They may all be from one person, but they could be from two.

This burial area is different from the burials in the front part of the cave in several ways. One difference is that none of the bones were burned. Also, most of the bone was in very small fragments, and there was a lot of red ocher. In addition, with the exception of the pottery, there were no grave goods, such as the beads and earrings found in the front part of the cave. These differences are interesting, particularly since this area dates in the same time range as the front burial areas. These differences are discussed more fully in a later section of the paper.

In the rest of the layer, to the west of the burial area, were 84 sherds. In the lower part of the layer, from 96 to 100-119 cm were 18 sherds. In the southwestern corner of the square at a depth of 116 cm was a spindle whorl (Fig. 7c).

### F13

F13 is in the central part of the cave at the west cave wall. Layer I sediment was very dark grayish brown (10YR 3/2) from the surface to c. 5 cm. There was 1 sherd in this layer. Layer II, from 5-8 cm, was brown (10YR 4/3 and 5/3) in the west, gradually changing to yellowish brown (10YR 5/4) in the east, and was 2-3 cm thick. It had no cultural remains. Layer III, from 8 to 29-44 cm was various shades of red, as in Layer III of H8. It contained a whole, small, ring-footed globular vessel (type shown in Fig. 13i). Layer IV, which went to 44-168 cm, was yellow brown (10YR 5/4) stony sediment with no cultural remains.

### K13

K13 is in the center of the cave. Layer I was very dark grayish-brown (10YR 3/2) sediment that contained no cultural remains. Layer II was the mottled sediment (dis-



cussed above under J17 stratigraphy). Level 1 of this layer contained 12 sherds. Level 2 had one sherd in the upper part of the level. Below this layer were stones.

#### J17

J17 was excavated in arbitrary 15 or 20 cm levels. The surface of J17 is very pale brown (10YR 8/3). From the surface to 15 cm the sediment was mostly very pale brown, but it had a small amount of mottling. Below this was mottled sediment (see J17 stratigraphy, above). Excavation level 1 contained bones and sherds. Level 2 had bones. Level 3 had one bone and a fired-clay earring (Fig. 5g). Level 4 contained three bones and a spindle whorl (Fig. 7d). Level 5 had two sherds. Level 6 had no cultural remains. Below this was a hard stony layer with no cultural remains.

#### *Number of Individuals Excavated*

In all, 16,765 bones and fragments were excavated. These are from a minimum of 57 people—48 adults, two adolescents, five children, and two infants. The numbers of people were determined by the types of bones and the location in the cave. Since most of the bone was fragmentary, much of it (e.g., rib and longbone shaft fragments) was useless in determining numbers of people. Bones such as carpals, tarsals, first and second vertebrae, and ends of longbones, however, can give numbers of people quite accurately. In each general area (the southeast stony area, where squares were grouped together because the bones were so scattered; the jar burial; H4/5; the west front area; the back-dirt in the large pothole; and H8) the minimum numbers were determined and then added together. I think all of the areas are far enough apart to constitute different burials, which is why I added their numbers.

The majority of the burials, representing at least 54 people, were in the front and southeastern areas of the cave. Only about 15 percent of these areas of the cave was actually excavated, so the entire number of burials could be over 400. There are probably no more than ten people buried in the entire rest of the cave.

### EXCAVATED ARTIFACTS

#### *Pottery*

Associated with the burials in the excavated areas was a considerable quantity of pottery. Nine whole or nearly whole vessels and 7310 sherds were excavated and analyzed. The pottery was made by paddle and anvil and has sand temper. There are four colors of pottery that are distinctive enough to denote differences in manufacture. The most common (45 percent) is red slipped. The second most common (23 percent) is various shades of orange, orange-brown, and light brown, the color variation being due to firing differences. Black, which includes grayish and brownish black, is 21 percent. This pottery is generally polished. Eleven percent of the pottery is dark red-brown.

Of the 7310 sherds, 6552 are body sherds, including 48 of carinated shoulders, 603 are rim sherds, 52 are of ring feet, and three are handles. The pottery is from approximately 311 vessels. This was determined on the basis of rim forms, colors, and excavated location.

For descriptive purposes the pottery can be divided into 11 types that probably have

functional significance: very small pots, small pots, globular vessels, pots, large pots, shallow bowls, bowls, large bowls, deep bowls, large deep bowls, and cylindrical jars.

Ten of the vessels are very small pots. They have a small mouth with a rim diameter of 6-12 cm, an everted rim, and a small globular body (Fig. 8a-e); two are stemmed (Fig. 8a,b). There are 30 small pots; they have small or shallow globular bodies and everted rims with diameters of 12-17 cm (Fig. 8f-r). There are seven globular vessels similar to the small pots but without an articulated rim; rim diameters are 12-18 cm (Fig. 13i-k).

Sixty-four of the vessels are pots with globular or deep bodies and everted rims with diameters of 14-22 cm (Fig. 9). The 29 large pots have rim diameters of 23-33 cm (Fig. 10a-m). The diameter of the bodies on some of them were probably over 50 cm. They are quite large enough to have been burial jars for secondary burials.

There are 107 bowls that can be divided into five types. Ten are shallow bowls or dishes, nine with rim diameters of 13-20 cm and one with rim diameter of 30 cm (Fig. 10n-u). The bowl illustrated in Figure 10o is oval, with a rim of 13.5 × 20 cm. It is red-brown with fine sand temper, and was found in layer 1 of K5/6. There are 39 bowls. Two have rim diameters of 12 cm; the rest are 16-26 cm (Fig. 11a-t). There are 37 large bowls with rim diameters of 24-33 cm (Fig. 11u-z, 12a-l). The remainder are deep bowls, 13 with rim diameters of 12-20 cm (Fig. 12m-s) and 8 large deep bowls with rim diameters of 22-25 cm (Fig. 13a-f).

Twenty-three vessels are cylindrical jars with straight or slightly curved sides and flat bases. Rim diameters are 18-32 cm (Fig. 13g,h,l,m, Fig. 14). At least some of them are wider than they are deep. Seventy-five percent of these jars are red slipped.

Forty-one vessels have rim sherds that are too small to determine vessel form. The 52 sherds of ring feet are from approximately 36 vessels, and the 48 carinated shoulders are from approximately 21 vessels.

Among all the pottery are only two whole vessels and two sherds that have any decoration other than a red slip. Both of the stemmed very small pots are decorated. One (Fig. 8b) has three sets of an incised decoration on the stem. The other (Fig. 8a) has 123 small incised lines made with a fingernail on the stem. Both are red slipped. One black rim sherd of a jar (Fig. 14e) and one body sherd each have six incised circles. There is also one flat black sherd with a woven mat impression.

### *Ornaments*

Many ornaments were found with the burials. The most common are beads, shell bracelets, and earrings. Two hundred thirty-four beads were excavated. Eight are small stone (shale) beads 3-4 mm in diameter (Fig. 6w-y). There are 165 small (3-5 mm) (Fig. 6n,o) and 56 large (7-12 mm) (Fig. 6p-t) shell beads. There are also two large oval shell beads (Fig. 6m,u), a large oval bone bead (Fig. 6v), and a large faceted wood bead (Fig. 6c).

There are 140 fragments of shell bracelets. They vary in thickness from 2-8 mm (Fig. 6d-f). There are also three fragments of very thin (1.5 mm) shell rings 25-30 mm in diameter (Fig. 6g). They could possibly be bracelets for infants, or they could be earrings.

Thirty-eight earrings and 26 fragments were excavated. Of the whole earrings, nine are made of shell, six of ground stone, two of jade, and 21 of fired clay. All of the shell earrings are of the lingling-o type (including one with a double body, Fig. 5o) and are

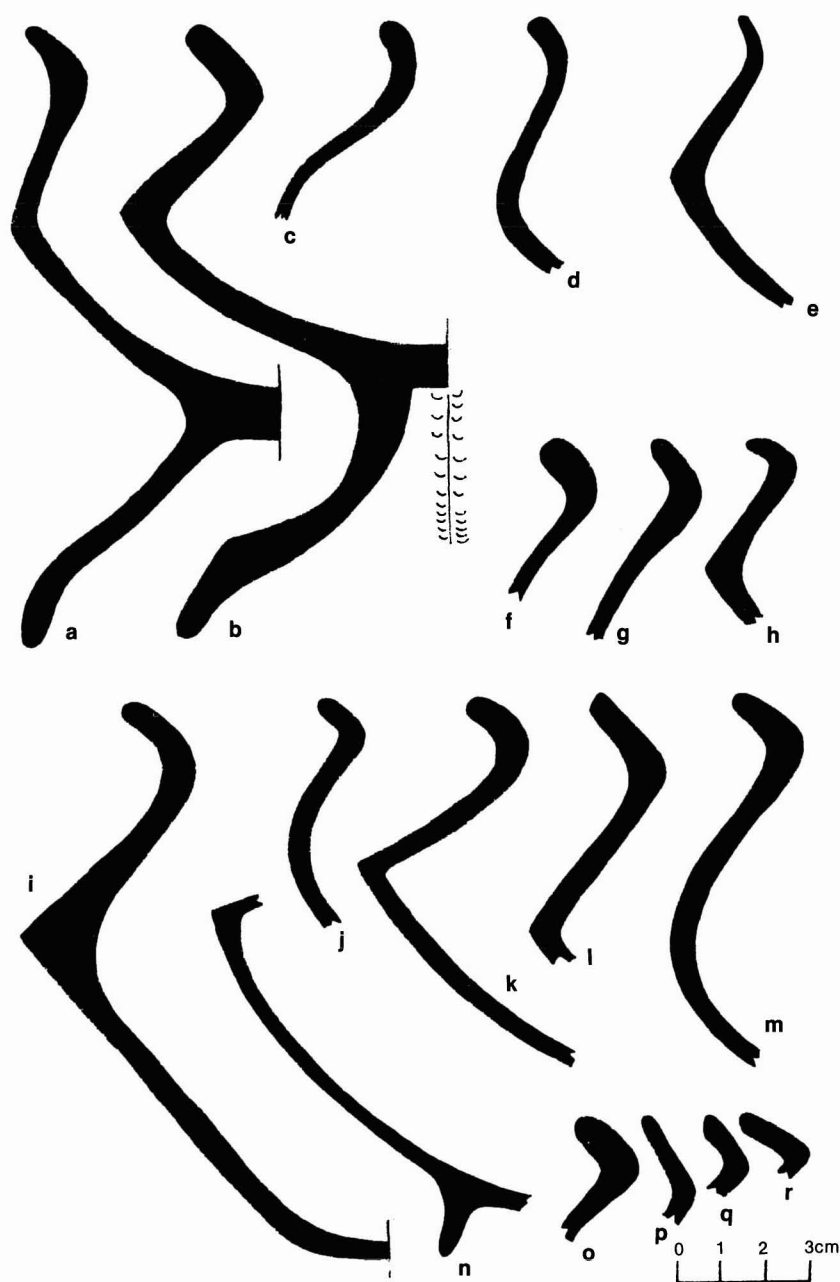


Fig. 8. *a-e*, very small pots, rim diameters 6-12 cm (*a* with 123 fingernail incisions on the stem, *b* with 3 incised decorations on the stem); *f-r*, small pots, rim diameters 12-17 cm.

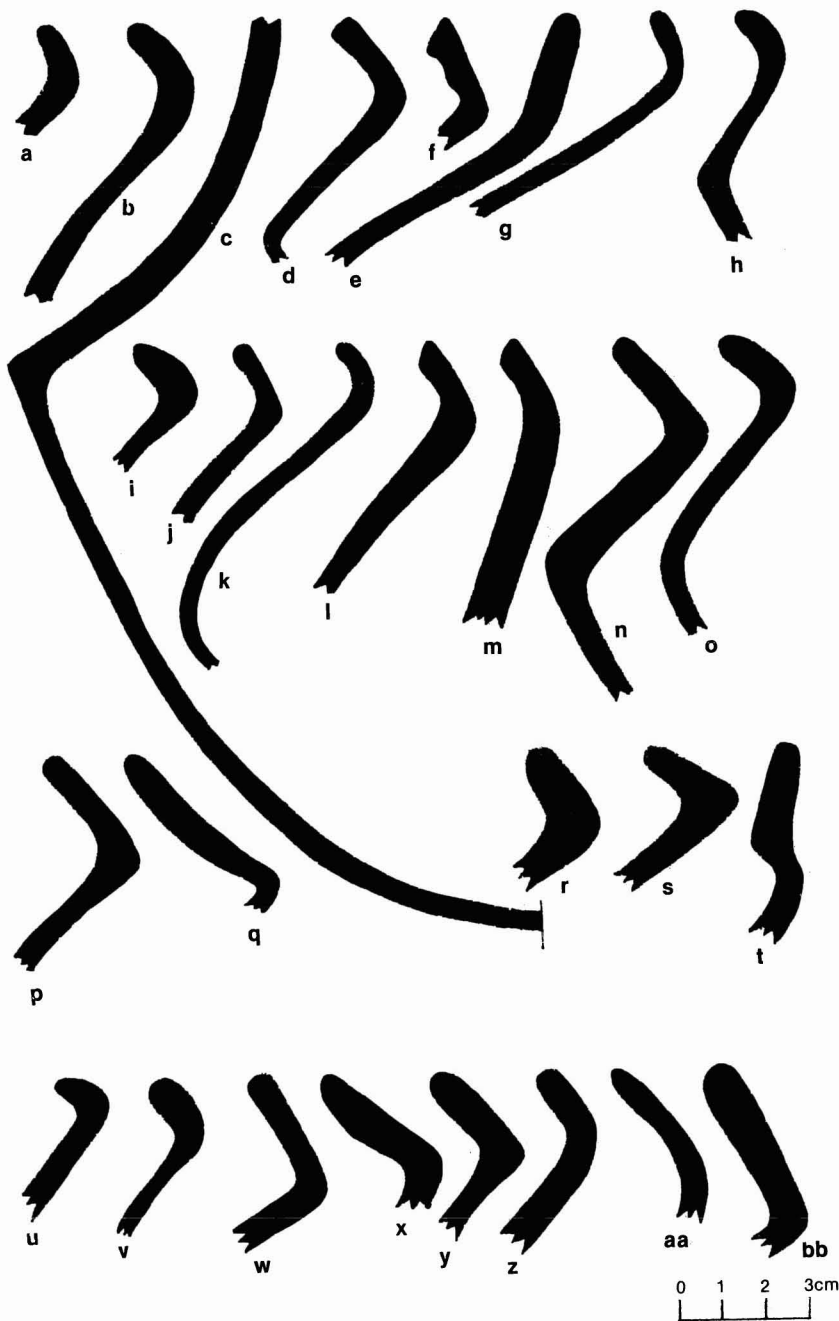


Fig. 9. Pots, rim diameters 14-22 cm.

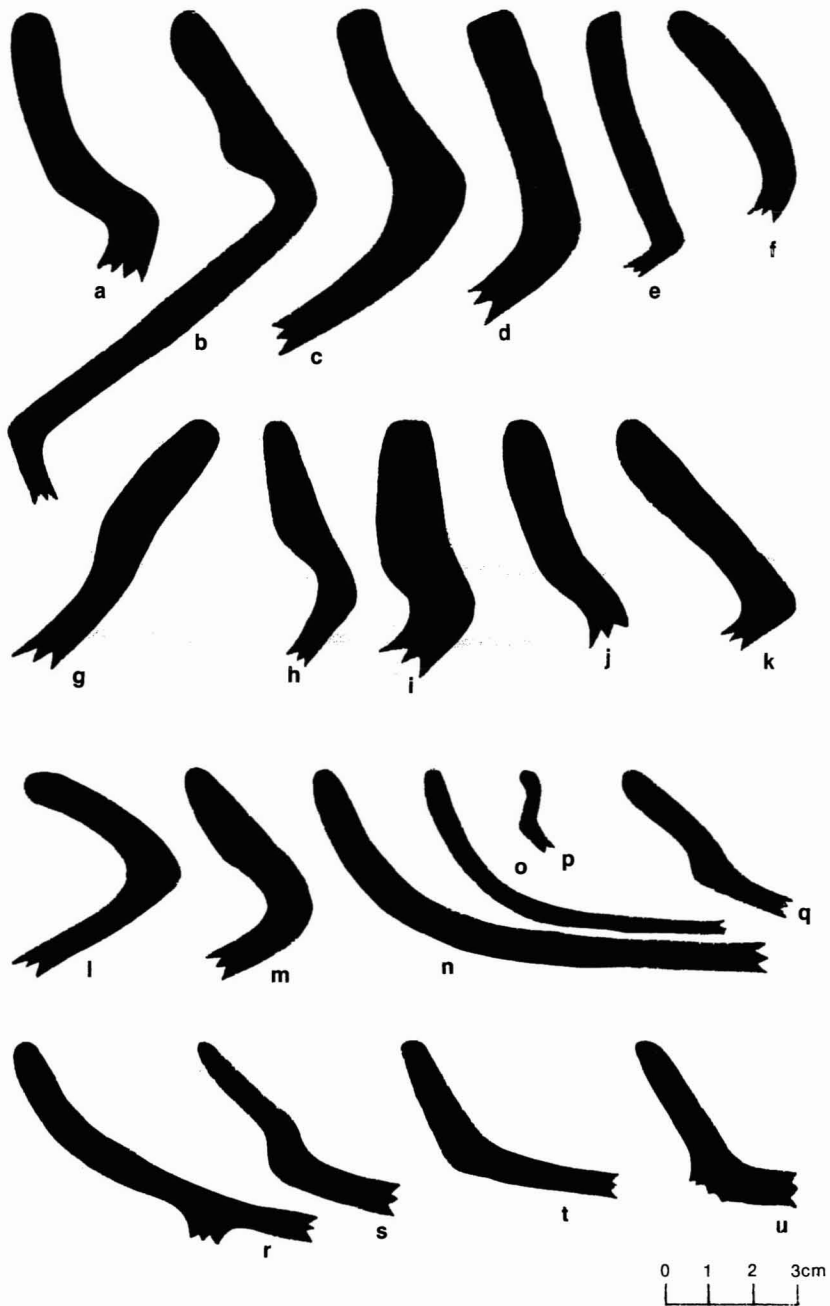


Fig. 10. *a-m*, large pots, rim diameters 23-33; *n-u*, shallow bowls, rim diameters 13-20 cm (*p* is oval, 13 x 20 cm).

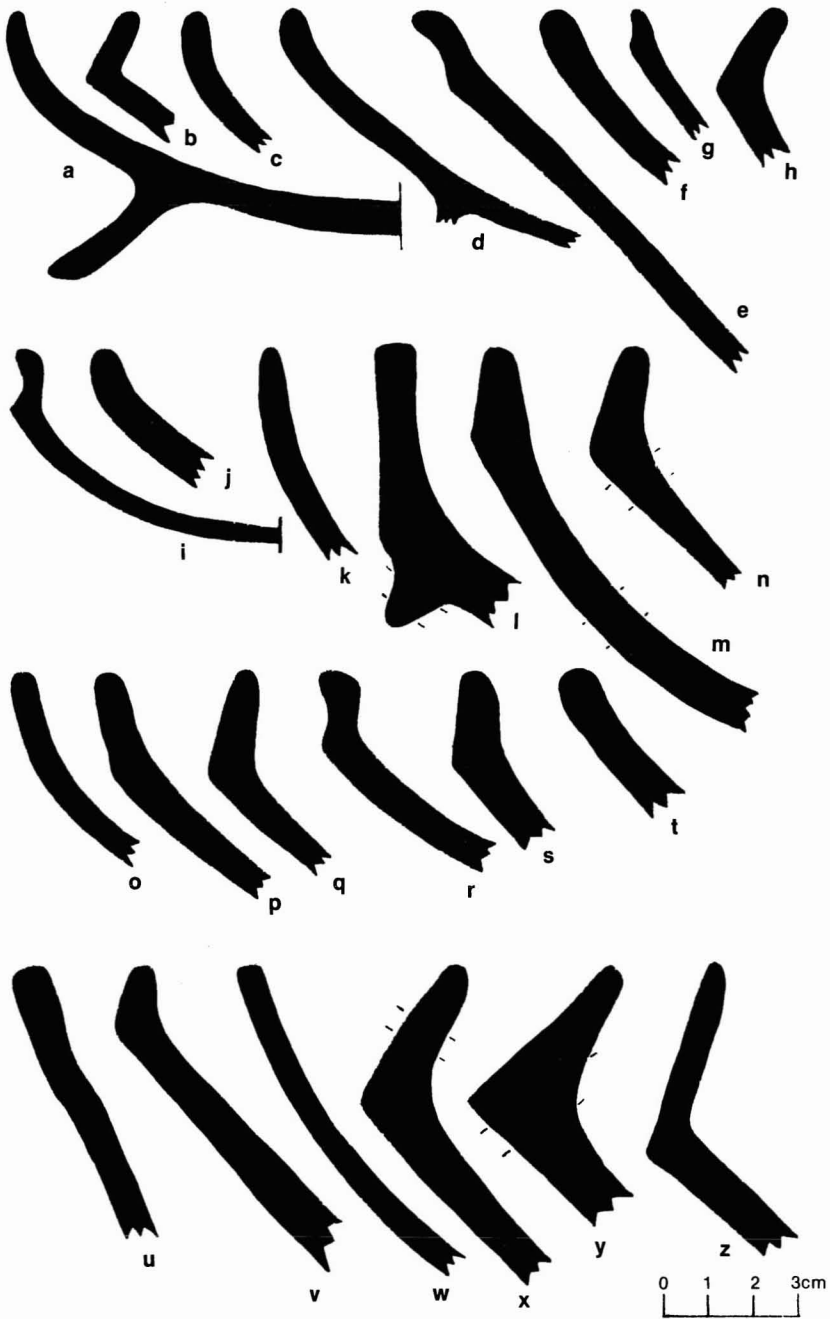


Fig. 11. a-t, bowls, rim diameters 16-26 cm; u-z, large bowls, rim diameters 24-33 cm.

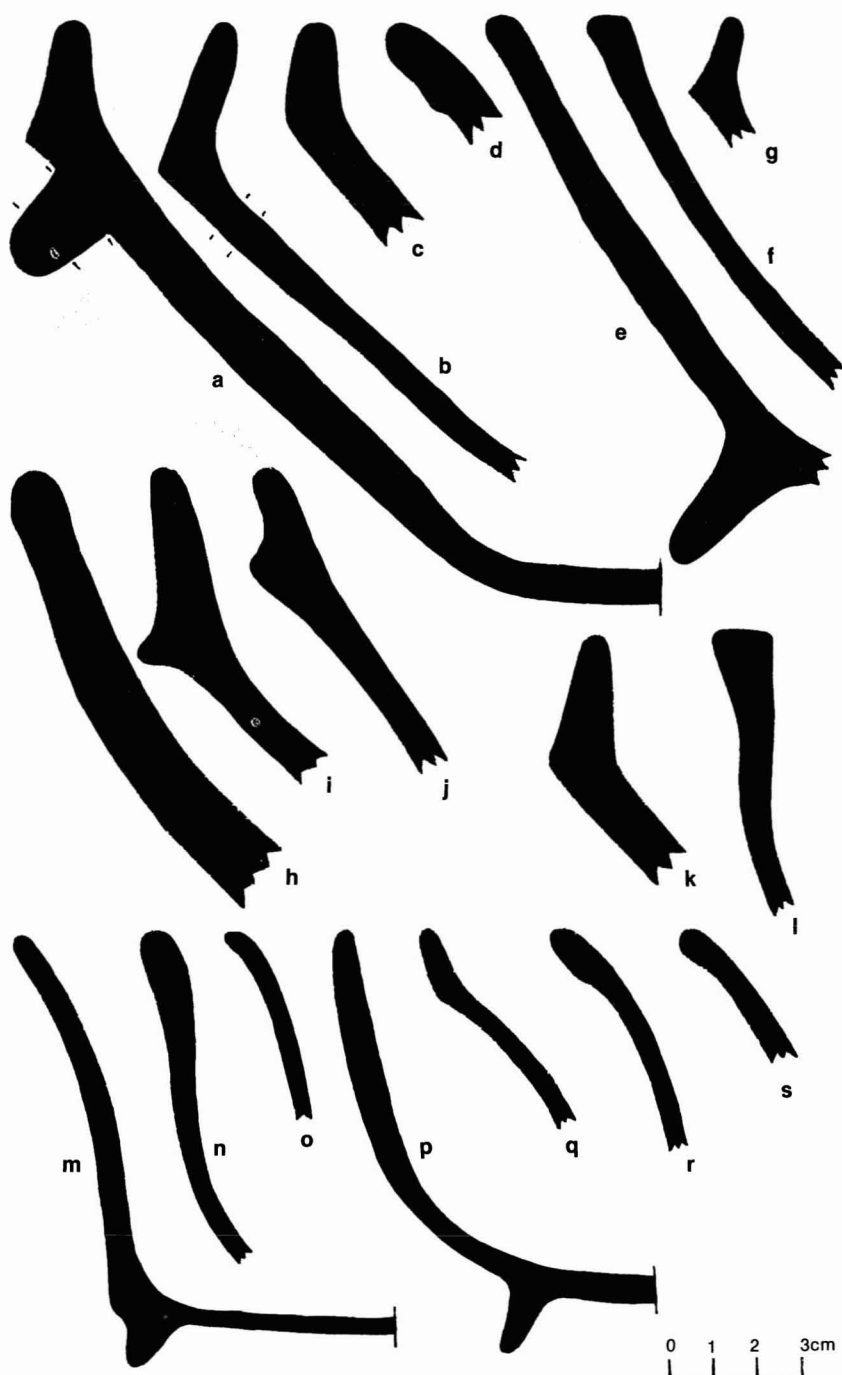


Fig. 12. *a-l*, large bowls, rim diameters 24–33 cm; *m-s*, deep bowls, rim diameters 12–20 cm.



Fig. 13. *a-f*, large deep bowls, rim diameters 22-25 cm; *g,h,l,m*, cylindrical jars, rim diameters 18-32 cm; *i-k*, globular vessels, rim diameter 12-18 cm.



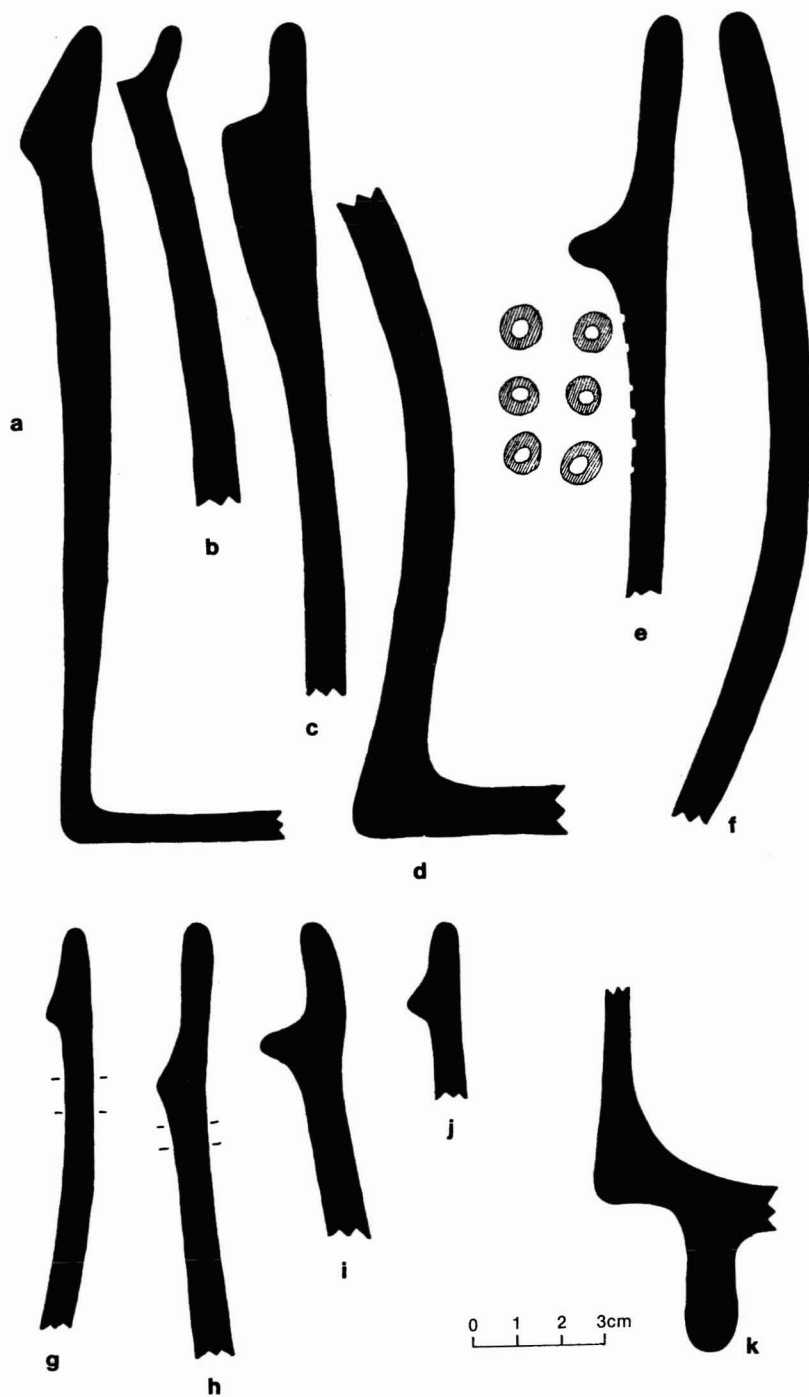


Fig. 14. Cylindrical jars, rim diameters 18-32 cm.

thin in cross-section (Fig. 5n-q). Four of the ground stone earrings are also of lingling-o type and are thin (Fig. 5l,m). The other two are both plain; one is 16 mm wide, the other is 2 mm wide (Fig. 5j,k). The two jade earrings both have the same plain, simple shape (Fig. 5r).

The fired-clay earrings are somewhat different in shape from most of the others. None are of lingling-o type. Also, they all have a globular (Fig. 5d) or somewhat-flattened globular shape (Fig. 5g). Two of them are flattened globular with a flat facet (Fig. 5a). Four are very small (these were associated with infant and young child burials) (Fig. 5i), and one is very large (Fig. 5h). Four of them have incised decorations. The very large one has various lines over almost the entire surface (Fig. 5h). One has concentric circles and lines on the bottom and another has a scroll pattern on the front. The fourth has five holes 3-4 mm deep on the front and bottom (Fig. 5b,f,c).

Other ornaments excavated are three *Conus* shell pendants(?) (Fig. 6a), one of which was covered with red paint (which was partially worn off), 71 drilled animal canine teeth (Fig. 6b), a small fragment of a shell disc, a red-slipped fired-clay disc, 11.3 cm in diameter and 1 cm thick with four holes near the edges (Fig. 7a), and five fragments of a boar tooth pendant(?). One cowrie shell was also excavated.

### Tools

A variety of tools was excavated. There are eight fired-clay spindle whorls and five fragments. Five spindle whorls are conical (Fig. 7c) and three are biconical (Fig. 7d). The fragments are all from biconical whorls. One ground sandstone barkcloth beater was excavated (Fig. 7j). The projection and the groove on the opposite end were probably used to haft it to a handle. The beater has two working sides. One side has six parallel ridges running lengthwise on the beater. The ridges are 3-4 mm high and 5 mm apart. The opposite side has 22 parallel ridges, c. 1 mm high and 1.5 mm apart.

Twelve points were excavated. Ten are made of bone. Five are of a blunted type (Fig. 6e,f,f), and five are barbed (all ten are broken) (Fig. 6a,a,g,g). There are also two finely ground broken points made of horn or bone (Fig. 6z). Six bone awls were excavated, four whole and two broken (Fig. 6c,c,d,d). There is also one wood awl (Fig. 6b,b).

The stone tools are adzes and flakes. Two trapezoidal ground stone adzes (Fig. 7b,i) and two pieces of a third adze were excavated. Fifteen flakes were excavated (Fig. 7e-h). These are all small (1-5 cm in length) amorphous tools with no recurrent forms, though some are blades. An edge wear analysis was conducted on the tools to determine their functions. The specific type of use of a flake alters the edge in a characteristic way. Various uses produce the removal of small flakes, striations, polish, gloss or sheen, rounding, or staining. For methods that are used in edge wear analyses see Honea (1983); Hayden (1979); Keeley (1980); Sinha and Glover (1984). Two of the Arku tools were used as knives and scrapers in woodworking. One was used in bamboo working. Another was used for animal butchering. Four of the tools are blades which have the characteristic sheen or gloss produced by grass or grain reaping (Fig. 7g,h). The remaining seven tools were used slightly, but their function could not be determined.

Four small whole spatulate objects were excavated. They are very finely ground and are probably made of horn; two have a serrated edge. They are possibly tattooing chisels (Fig. 6h-k). Another interesting item is a piece of knotted rope made from a vine (Fig. 6l).

## INTERPRETATION

The materials excavated can be used to interpret various aspects of the culture of the people who used Arku Cave. Most information relates to burial practices, but information on technology, subsistence patterns, economics, social organization, and other practices is also present. A wide range of burial types and practices is indicated, but all types are secondary burials. The most common is the large number of bones that were found scattered in various areas of the cave. It is possible that at the time of burial the bones were placed as we found them but it is more likely that they were placed neatly in one area, perhaps accompanied by a pot or other grave goods, and that they were later disturbed.

Other burial practices include bones placed on a ledge in the cave wall in the west front burial area. In H4/5 there was a skull colored red. There is one jar burial. There also may have been others that were too disturbed to recognize. There is also a skull that was placed in a pot. A common practice is cremation. Approximately 34 percent of the bones were burned in a high heat, which was undoubtedly from intentional cremations.

The burial from the southern part of J5 that had the red ocher, a small stemmed pot, and other grave goods together with the bones of four or five adults is another type. The other burial with a small stemmed pot, in H8, contained very small bone fragments and red ocher and was surrounded by more small bone fragments and red ocher. This latter burial is different from the others in that it did not have any associated grave goods. The two pits with bones and ash that were found in Layer III of K5/6 are still another burial type.

Arku Cave produced a sequence of radiocarbon dates ending at 75 B.C. (two-sigma range 370 B.C. to A.D. 220) (at a depth of 32 cm). Cultural materials were found above 32 cm, indicating that the site was probably used after 75 B.C. However, the artifacts are of typical Late Neolithic type, and no metal of any kind was found. It is likely that the cave was only used during this time period and that it had gone out of use by A.D. 500 or earlier. It is also possible that it was used more recently.

The time of earliest use is problematic because the earliest date has the large error, with a two-sigma range of 7740–1940 B.C. A date at the younger end of this range is reasonable from its stratigraphic location. Judging from its location and associations, the actual age is probably no older than 2500 B.C., with 2000 B.C. being more likely.

The shortest time range from all (excluding GaK-7039) of the dates produces a use time of from 890 to 370 B.C. (520 years). However, something must be added for GaK-7039, so the site was undoubtedly used for over 600 years. The longest range from the dates (but using 2000 B.C. for GaK-7039) produces a use time of 2000 B.C. to A.D. 220, over 2200 years. Given the fact that the artifact types do not vary significantly during the use of the cave, the time period is probably less than 2000 years and closer to 1500 years or less. Whether the cave was used fairly steadily or only periodically cannot be determined.

The cave contains a wide variety of burial practices for one site. Also, the pottery styles and artifact types do not vary significantly, which probably indicates that there was considerable cultural continuity in the people who used the cave. The range of burial practices is therefore somewhat surprising. There are some aspects of the burial practices that do continue over time; for example, all types are secondary burials, some cremation is practiced, and similar types of grave goods are placed with the burials. There are also many distinctive burial practices, however, as discussed above.

There are several possible explanations for the variety of burial practices. One is that the differences are due to temporal variation. Although this may account for some of the variation, it is unlikely that it accounts for all of it; some of the burial types have been found only once, such as the small stemmed vessel containing bones and red ocher. Only part of the cave was excavated, however, and some of the practices may in fact have been more common than the excavations indicate.

Another possible explanation is that more than one cultural group of people used the cave during the same time periods, although this is probably unlikely. The variation could also be due to a combination of cultural and temporal variation.

Still another possible explanation is that different burial practices were used by the same cultural group. The differences could be related to social status, people of higher status receiving more grave goods and different types of burial than lower status people. Different kin groups within the society also may have had different preferred burial practices. Variation in the same cultural group along with some temporal variation is a likely explanation for the different burial practices.

In addition to information on the burial practices of the people who used the cave, the excavated artifacts also give information on the technology, subsistence patterns, economics, and social organization of those people. The technology was based on stone and bone tools. The ground stone adzes are woodworking tools. The flake tools were used in woodworking, bamboo working, animal butchering, and possibly grain reaping. The sheen on some of the blades is in the characteristic crescent shape that is produced by grain reaping, but sheen can also be produced by cutting other materials. The bone points indicate hunting.

The pottery is well made, and the vessel forms indicate a variety of uses. Whether the pottery was made locally or obtained in trade cannot be determined without additional archaeological work in the area. The barkcloth beater was undoubtedly used to manufacture barkcloth. There are also spindle whorls present, so the people probably also spun fibers into thread and wove cloth. The barkcloth beater and a spindle whorl were both found in the same level of the same square (level 4 in H4/5, with a date of 935 B.C.); both barkcloth and woven cloth may have been used in the same time period.

The various beads, earrings, other ornaments, and tattooing chisels could have been manufactured locally or obtained in trade. It is likely that at least some of them were made in the area. All of the necessary raw materials are locally available, even jade for the earrings. Jade flake tools were excavated at Musang Cave, a habitation site 1.5 km downriver from Arku Cave. They date from approximately 10,000 to 3000 B.C.; undoubtedly there is a local source of jade in the area (Thiel 1980). Further analyses could determine if the source materials for the jade artifacts at both sites are the same.

There is at least some evidence at the site for trade or contacts with other areas. Both the cowrie and *Conus* are sea shells and were probably obtained in trade. Trade and contacts with other areas are discussed further below.

Information on subsistence patterns comes from various excavated materials. The bone points indicate hunting, and the people probably also did some gathering. Agriculture was probably also a major subsistence activity. The types of artifacts excavated are generally associated with neolithic agricultural people. Whether the people were horticulturalists or rice agriculturalists cannot be determined without excavating a village site where they lived, but there is some indirect evidence from the site that relates to this question. One is the blade tools with sheen. This type of sheen can be produced by reaping grains such as rice, but it can also be produced by cutting wild grasses and grains.

Therefore, these tools do not give conclusive evidence of agriculture (Sinha and Glover 1984).

Another item of data is the skull of the 11–14-year-old child with porotic hyperostosis that was found in Layer II of K5/6. Porotic hyperostosis produces holes and lesions on the skull. The conditions that most commonly produce it are thalasaemia, sickle-cell anemia, and iron-deficiency anemia. The first two are genetic diseases in which the heterozygote individual has a selective advantage in a malarial environment. Iron-deficiency anemia can arise from insufficient iron ingestion, interference with intestinal absorption of iron by high consumption of cereal grains high in phytate (such as rice or corn), heavy infestation with intestinal parasites, or a combination of any of these. All are commonly found in agricultural societies. Both thalasaemia and sickle-cell anemia are now present in the Philippines, although the latter is rare and is more commonly found in African populations. Iron-deficiency anemia can occur anywhere in the world. In general, porotic hyperostosis is highly suggestive of agricultural subsistence but not conclusive. The paleopathologist who looked at the bones and identified the pathology stated that the child is somewhat old for survival with either thalasaemia or sickle-cell anemia (but this could be what killed the child), and that iron-deficiency anemia is the most likely cause in this case (Klepinger, pers. comm.). This analysis strongly suggests that rice agriculture was part of the subsistence pattern.

Another kind of cultural information that can be obtained from the burials concerns the type of social organization of the society who buried their dead in the cave. There are definite differences in the types and amounts of grave goods that were placed within the various burial areas, which indicates probable social status differences among the people. The various types of burial practices also may be related to status differences. It is likely that these are ascribed rather than achieved status differences, because there are young individuals that have many grave goods and older individuals who have few goods. In particular, the young man whose skull was placed in the pot in Layer II of K5/6 had a great deal of grave goods even though he was very young at the time of death. Excavation of a village site could provide more information on the type of social organization present in the society, as well as other aspects of culture.

## EXTERNAL RELATIONSHIPS

Arku Cave has many similarities to and also some important differences from other sites in the Philippines and other areas of Southeast Asia. The various burial practices themselves are all common, though it is not common to have as much variety at one site. Secondary burials, burial in caves, jar burial, placing skulls in pots, the types of grave goods placed with the bones, red ocher used in burials, and a red wash made with red ocher on bones are all found in other areas of the Philippines in Late Neolithic and Iron Age times. A burial type found at Arku that is somewhat different and has not been found elsewhere is the very small stemmed pot that contained small bone fragments and pieces of red ocher, surrounded by more bone fragments and red ocher.

A more important burial practice that is common at Arku but not present elsewhere is cremation. Cremations have not been found at any site in Island Southeast Asia that dates before the thirteenth century A.D. It is very interesting that cremations are found at Arku during the entire period of use of the cave.

The Arku pottery is an artifact type that can be compared to other regions. The vessel

forms are somewhat similar to those of the Tabon pottery complex in Palawan (Fox 1970), which is over 1000 km south of Arku. A red slip is present on some of the Tabon vessels, as at Arku, but the Tabon pottery also has several other forms of decoration that are not present at Arku.

The Arku pottery is different from two other main pottery complexes in the Philippines: the Sa-Huynh-Kalanay, found in the central and southern Philippines as well as other areas of Southeast Asia, and the Lal-lo pottery complex, which is found in northern Luzon, only 60 km north of Arku (Thiel 1986-1987). Arku dates from the same time period as early Lal-lo, but the Arku pottery is very different from that of the Lal-lo complex.

Some of the vessel forms at Arku are very rare in Island Southeast Asia. One distinctive vessel form is the oval bowl. The only other oval bowl in the literature is from the central Philippines (Solheim 1964:157). Another uncommon form is the cylindrical jar with straight sides and flat base. Twenty-three vessels of this form were excavated at Arku. Similar vessels have been found in the central Philippines (Solheim 1964:92, 123) and Indonesia (Bellwood 1980:97). Vessels with similar shape have also been found on the mainland at Gua Cha in Malaysia (Sieveking 1954), but whether the pottery from these sites has any relationship to the Arku pottery through trade or other contacts cannot be determined without further research.

Various other artifacts from Arku are similar to those found at other sites in the Philippines and other areas of Southeast Asia. The trapezoidal ground stone adzes are a common Late Neolithic type. The bracelets, spindle whorls, drilled animal teeth, and most of the beads are also common types. The faceted wood bead is unusual, although there is one of almost identical form made of jade from Tabon cave (Fox 1970:141g).

The tattooing chisels (assuming this is the correct identification) are unique in Southeast Asia, but the ones with serrated ends are similar to ones from Tongatapu, Tonga, Polynesia (Bellwood 1979:254). Barkcloth beaters are found in the Philippines and other areas of Southeast Asia, and one with two working sides has been found in Cebu, Philippines (Beyer 1948). But the Arku beater is unique in that it has a projection for hafting on a two-sided beater.

The Arku earrings give the most direct evidence for trade or contacts with other areas. In particular, there are forms of lingling-o earrings from Arku that are nearly identical in form to some from the Tabon caves (compare Fig. 5*l*, *n*, and *d* with Fox's [1970] figures 37*d*, *h*, and 43*a*, respectively). Similar forms of earrings are also found in other areas of the Philippines and both Island and Mainland Southeast Asia. However, there are differences at Arku. Most earrings from other areas are made of jade or shell. Both jade and shell earrings are found at Arku, but most Arku earrings are made of fired clay. The incised fired-clay earrings and the very small and large earrings have not been found at other sites.

The various lingling-o styles are too similar to those from other areas to be the result of chance stylistic invention. They are undoubtedly the result of contacts with other areas that probably involved trade. Trade is a recognized part of Southeast Asian prehistory, but it was probably more important at an earlier date than is generally thought (Solheim 1976; Thiel 1984-1985).

Arku Cave has similarities with other areas but also many important differences and unique aspects. It seems that the Arku people were involved in some trade and had some contacts with other areas while remaining isolated enough to maintain many distinctive aspects of culture. Interpretation of trade and contacts is hampered by the lack of sites in

northern Luzon from the same time period. Further excavation is needed to determine more about these relationships.

### CONCLUSIONS

Arku Cave is an important site because it extends our knowledge of Philippine prehistory. Many items excavated at the cave have not been found elsewhere, undoubtedly because of the small amount of archaeological research that has been done in the area and in the Philippines in general. The materials excavated at the cave also give information on a variety of cultural aspects of the people who used the cave for burial. The information on subsistence patterns, trade, and contacts also offers some important directions for further research.

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